The Bulletin

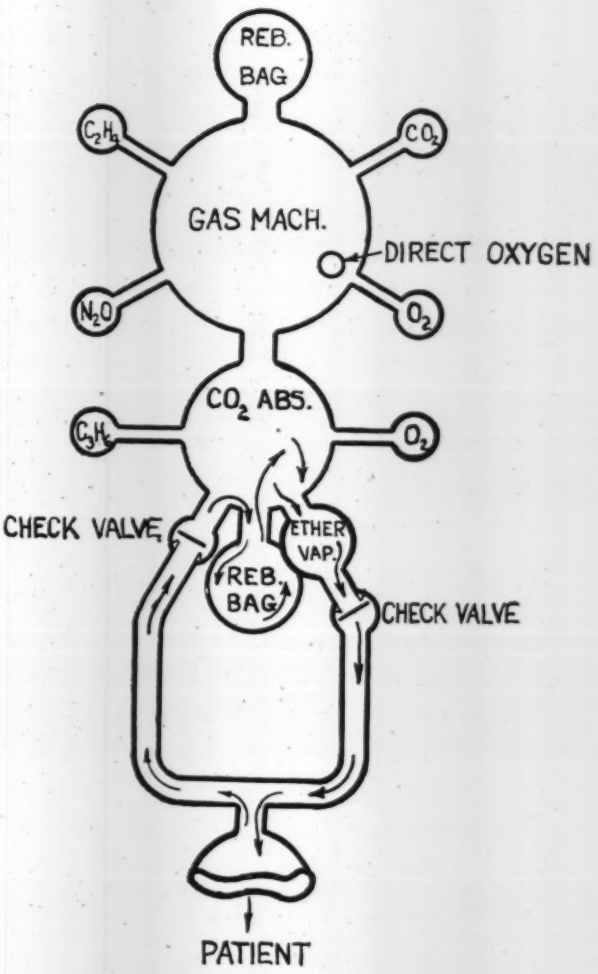
of the

American Association of Nurse Anesthetists

NOVEMBER
1943

VOLUME XI NUMBER 4

The illustration is shown to get new personnel better acquainted with the many Model L Nargraf Units now in use.



Diagrammatical Sketch of McKesson Model L Nargraf

The gas machine head has a mixing chamber with a Vernier dial which measures the anesthetic gases in accurate percentages with oxygen graduated to 1% changes. The flow of the mixed gases is controlled by the pressure dial. The pressure range is from "0" mm mercury to "40." If the Absorber control is set at "Change" position and the Pressure Control at "0," the mixture does not flow by itself, but the patient may inhale from the unit. It will deliver as much as he desires to take at each inhalation. This is called the *Intermittent Flow* principle. At this incident the exhaling valve is left open and the exhaled gases pass into the atmosphere.

If the pressure is slightly increased, and the back rebreather bag turned on, the bag will inflate first and the excess exhalation will pass out through the exhaling valve. When he inhales, he first gets the mixture from the bag, and then the machine automatically delivers fresh mixtures. He is now rebreathing some of the exhaled gas and the incident is called *Fractional Rebreathing* or *Semi-Open.*

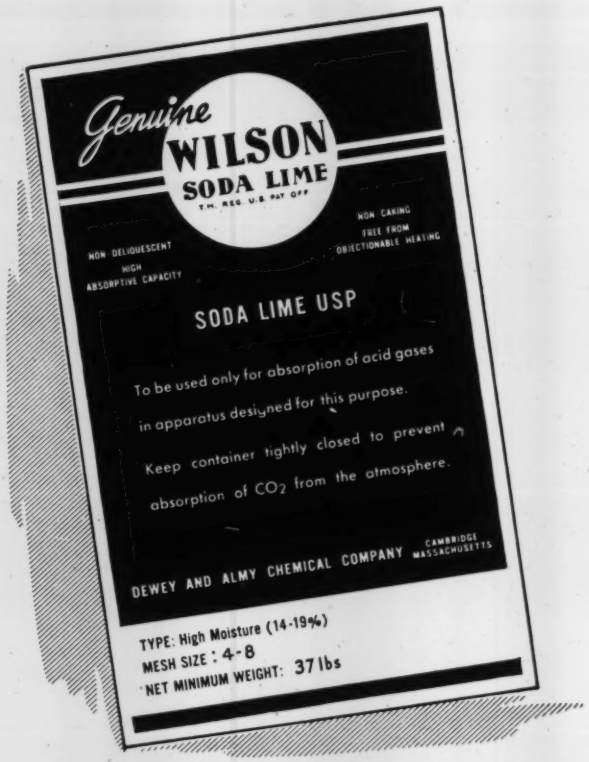
If the back is shut off and the Absorber Control at "ON," the large rebreathing bag will fill with the mixture and the patient will be on *Circle Filter* with full absorption of the CO_2. At positions marked "1," "2," "3," and "OFF" the desired amount of absorption of the CO_2 may be obtained. This incident is called *Total Rebreathing.*

Ether may be administered at any time by opening the control, thus allowing the gas mixture to pass through the vaporizer.

By pressing the direct oxygen button, the flow of the mixture is stopped and oxygen is delivered to the patient. The metabolic oxygen requirement is supplied during *Total Rebreathing* by use of the flow meter on the absorber. Cyclopropane is administered by a flow meter mounted on the opposite side.

(Additional information will be supplied upon request)

McKESSON APPLIANCE COMPANY
Toledo, Ohio



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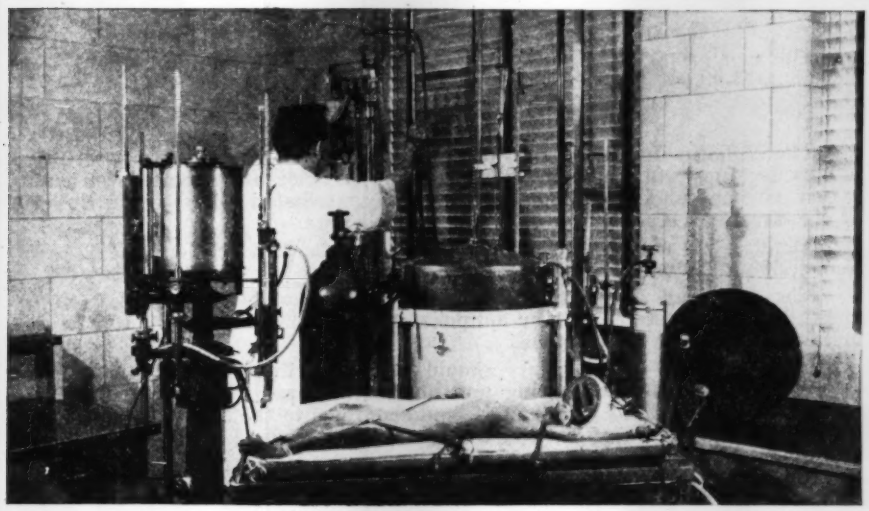

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The Bulletin of the American Association of Nurse Anesthetists

VOLUME XI, NO. 4 NOVEMBER, 1943

THE CONTENTS

ANESTHESIA IN THORACIC SURGERY

T. J. SNODGRASS, M.D.
Surgeon
and
LEONE MYERS
Anesthetist
Pember-Nuzum Clinic, Janesville, Wisconsin

Read at the annual meeting of the Tri-State Nurse Anesthetists' Assembly, held in Chicago, May 5-7, 1943.

The title of this discussion is somewhat misleading, for the surgery of tuberculosis is now only a small part of the rapidly expanding field of thoracic surgery. Those of you who have managed the anesthetic in an esophagectomy or pneumonectomy will feel that anesthesia in collapse therapy is a comparatively simple problem. The majority of anesthetists, and surgeons as well, however, have had little experience in the surgery of tuberculosis, and without some knowledge of the surgical problem itself, little could be gained by a discussion of the question of anesthesia.

Pulmonary tuberculosis is a very chronic, destructive disease, which breaks down portions of the lungs, usually attacking the apices, first producing areas of infiltration which later break down into cavities. As long as the cavities are open, they act as foci of infection from which the tubercle bacilli are constantly thrown out, infecting other parts of the lung and the intestinal tract, and what is more serious, exposing others to the ravages of the disease. The disease is arrested by a process of healing which involves fibrosis and contraction of the diseased portion of the lung into a scar, often seen as a small deposit of calcium. The rigid, bony chest wall puts a limit on the amount of contraction which can take place, and if the cavities are large, they remain open indefinitely because of the anatomical structure of the thoracic cage. The other important characteristic of tuberculosis is its extreme chronicity, often requiring years to reach the stage described. With prolonged invalidism and treatment in bed, the reserve vitality so essential for major surgery and anesthesia becomes less, and as more lung tissue is destroyed, the so-called "vital capacity" (the amount of air the lungs can take in) becomes only a fraction of what it should be normally. This fact, together with the nature of the operation, which is for the purpose of collapsing a portion or all of the already crippled lung, makes the anesthesia, itself, a major problem.

The nature of the disease is such that the lesion seldom can be removed, and while rest is the most essential factor in healing, due to the constant respiratory excursion, that factor of rest is difficult to obtain. It is accom-

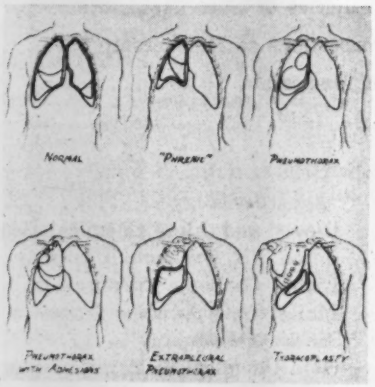

FIGURE 1

plished, however, in a measure by allowing the diseased area to collapse. The several methods most commonly used are illustrated in the diagrammatic drawing (Figure 1). The most simple, and a very effective method, is the interruption of the phrenic nerve which paralyzes the diaphragm and allows it to rise in the thorax, diminishing its capacity by from 10 to 30 per cent. This is a simple operation done under local anesthesia. Pinching the nerve with a hemostat will put the diaphragm at rest for from four to six months.

The most common method used is pneumothorax, or the injection of air between the layers of pleura, allowing the lung to collapse down sufficiently to put the diseased portion at rest and close the cavities. Because tuberculosis frequently involves the pleura, adhesions between the layers are produced which interfere with proper collapse, holding the cavity open like a guy rope on a tent. If they are not too extensive, they may be cut by an electrosurgical unit through a thoracoscope. The operations just described can be performed under local anesthesia.

Pneumothorax is limited in its usefulness by the presence of obliterative pleuritis, in many cases making the collapse impossible. Recently the operation of extrapleural pneumothorax has been designed to extend the usefulness of pneumothorax further. Through a small incision, either anteriorly or posteriorly, over the upper part of the chest, a section of one of the upper ribs is removed, and a plane of dissection is established between the thoracic wall and the parietal pleura, stripping this off over the apex of the lung and down the chest wall far enough to allow adequate collapse of the diseased portion of the lung. The space is then filled with physiological saline, and the wound is closed air tight, so that later the fluid is aspirated and replaced with air. This operation is performed in one stage, usually under general anesthesia.

The operations thus far described have been of the revocable or temporary type. They are of such a nature that once the disease is under control, the lung can be allowed to reexpand by absorption of the air, and function can be re-established. This is more theoretical than practical, however. Many patients need permanent collapse, which requires that the chest wall be allowed to drop in against the diseased and contracting lung. This is accomplished by the removal of the bony cage which maintains the thoracic cavity. When the operation of thoracoplasty was first attempted, a large number of ribs were excised in one stage, and few patients survived the ordeal. Now it is accomplished in many stages, taking two or three ribs at a time, and allowing the patient a period between stages to adjust himself to the mechanical change in the respiratory apparatus, and to recover from a major operation.

The upper thoracic cage is exposed through a long, curved incision beginning between the upper scapula and first thoracic vertebra, curving around below the scapula to the posterior axillary line, or further if necessary to mobilize the scapula and expose the second and first ribs, which are usually removed completely in the first stage. Subsequently, this incision is reopened and additional ribs, together with the transverse processes, are excised, treating the rib beds chemically to delay the reformation of the ribs until adequate collapse is obtained. This operation may be confined to a small area over the apex, or it may completely obliterate one side of the thorax where the disease is extensive.

Blood loss is a considerable hazard, but it can be replaced by transfusion during the operation. Besides the generally poor condition of the patient, another important factor is the change in the respiratory mechanism caused by the loss of a portion of the bony frame work. The released lung and chest wall tend to draw into the thoracic cavity as the patient expands his chest, diminishing the intake of air, so-called paradoxical respiration, often seriously interfering with proper respiratory exchange. This is overcome somewhat by packing the cavity with a surgical pad, and the use of a tight pressure dressing after closure. This is, nevertheless, an important element in the danger of the operation. The other more remote danger is that during the collapse of cavities, infected material will be forced out into the bronchial tree and aspirated into healthy portions of the respiratory system, thus causing a spread of the disease to the opposite lung. Much of the responsibility for preventing this rests upon the anesthetist.

The fundamental requirements of an anesthesia for thoracic surgery are:

1. To relieve all pain and discomfort.
2. To allow a maximum of oxygen with the minimum of respiratory excursion.
3. To minimize both surgical and psychological shock.
4. To produce the least possible irritation in the lungs.
5. To control the respiration.
6. To maintain the cough reflex, or to restore it immediately.

Local anesthesia fulfills most of these requirements for thoracoplasty, but it prolongs the operation, and patients dread subsequent stages.

Open drop ether is dangerous in pulmonary disease because of irritation, especially in tuberculosis, but ether is used successfully by the closed method in conjunction with the gases. Epidural and spinal anesthesia have been employed successfully in a large series of cases. Intravenous anesthesia has its advocates, and others use nothing but nitrous oxide and oxygen. When the electrosurgical unit is used, nitrous oxide and oxygen is the only inhalation anesthetic that is safe, but there is the disadvantage of a wide excursion of the lung, making the operation more difficult. The combination of local novocaine infiltration anesthesia and cyclopropane-oxygen absorption technique appears to fulfill most of the requirements, namely, rapid induction and recovery, maximum oxygen with minimum lung excursion, absence of lung irritation, and adequate control. Patients do not dread the anesthesia in subsequent stages, and the combination of local and inhalation anesthesia theoretically prevents shock.

The position of the patient and the technique of administering the anesthetic are better explained by the one who sits at the head of the table, Miss Leone Myers.

The tuberculous patient is frequently a poor risk for anesthesia because of debility, elevated metabolic rate, secondary anemia, low vital capacity, sputum and excessive bronchial secretions which increase the danger of postoperative atelectasis, and the spread of the disease. With these factors in mind, the anesthesia is a real problem.

Cyclopropane has been used in our surgery for many years, and has proved to be the most satisfactory anesthetic. In cases of secondary anemia and increased basal metabolic rate, it is imperative that a liberal supply of oxygen reach the blood stream during anesthesia. The high oxygen content employed produces minimal lung excursions. The rapidity of induction

is advantageous to the patient in view of the many stages necessary in the operation.

Premedication with a barbiturate is given one and one-half to two hours, and morphine forty-five minutes, before surgery. The operation is scheduled for late morning, giving the patient an opportunity to clear as much waste as possible from the chest and throat. The patient is brought to surgery just before the anesthetic is to be given, and placed on the table in the proper position. If the anterior stage is scheduled, the patient is placed on his back. If a posterior lateral right or left thoracoplasty is to be performed, the patient is placed on his good side with the arms out-

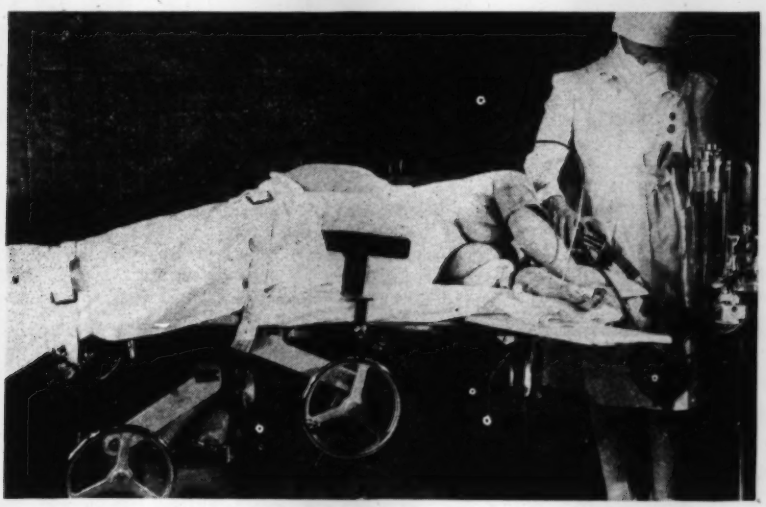

FIGURE 2

stretched and placed on an arm board. This arrangement is an advantage in thoracic surgery because the anesthetist can observe the color of the skin. If cyanosis appears, the position can be altered to correct it before the patient is anesthetized. Changing the angle of the shoulders or arms, or placing a pad underneath the axilla frequently will prevent interference with respiration. The slight Trendelenburg position is employed to encourage drainage to the mask area. Padded braces are used on both sides of the pelvis to prevent the patient from falling to either side. Two straps are used, one over the hip and one over the knees (Figures 2 and 3).

Blood pressure readings are made during the operation, but respiratory observations are the best guide here, as well as in all other fields of anesthesia.

The induction is begun by filling the bag two-thirds full of oxygen, or enough to allow for the tidal excursions of the patient's respirations; then 500 cc. per minute of both oxygen and cyclopropane for three to five minutes are given. The oxygen usually remains at 500 cc. per minute, but frequently 600 cc. per minute are required. The cyclopropane is cut off at the end of three to five minutes. It is given as indicated by signs and not by the estimates of percentages. The patient is permitted to breathe into the closed circuit for one to two min-

utes, and then is given 100 to 200 cc. per minute for one to two minute intervals. An anesthetic mixture of 90% oxygen and 10% cyclopropane is used in most cases.

Patients are well anesthetized during the rib dissection and removal. As collapse takes place, some respiratory changes are noted. This observation is interesting from the standpoint of the patient's previous condition; that is, if the lung on which the patient is resting is not affected by the disease, surgical collapse will not alter the respiratory rate to a very great degree, but if the reverse is true, some difficulty is encountered and oxygen under positive pressure is needed. Inasmuch as these operations are always done with the patient lying on the good side, the muscular work involved in respiration causes extreme fatigue in a short time. Therefore, it is well to preserve all muscle tone possible throughout the operation. Adequate suction or sufficient aspiration of secretions should be employed to allow proper oxygenation through the limited lung space, and also to prevent postoperative pulmonary complications which occur in tuberculous patients following anesthesia, and are the result of aspiration of secretions formed during induction rather than the result of irritation by the anesthetic agent. Mechanical assistance may also be needed to aid the respirations until the wound is closed and the patient's position can be changed. Helium is used to advantage at this point in the procedure.

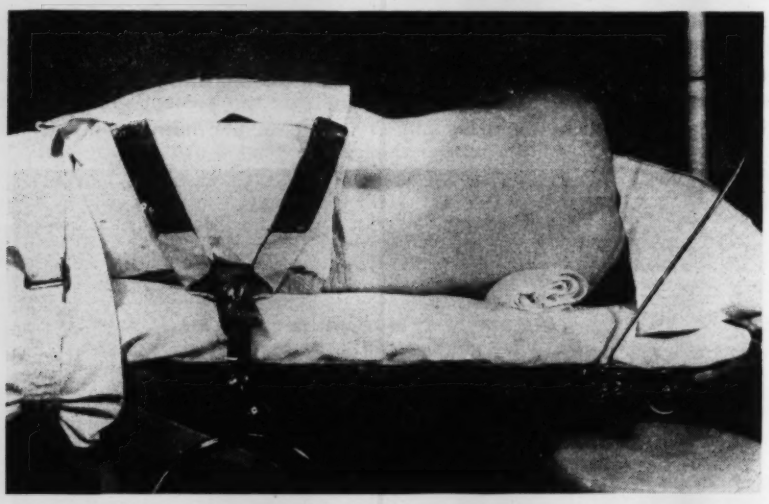

FIGURE 3

The blood pressure and pulse levels are maintained provided that the fluids lost are replaced by blood and physiological saline, during the operation. In a few instances, we have felt that patients who had involvement of both lungs approached shock during surgery, especially where paradoxical breathing followed tremendous collapse.

The anesthetist who is striving to maintain her ideals and training in anesthesiology is not only interested in alleviating pain during surgery, but she also has in mind the postoperative recovery of the patient. Pa-

tients having been subjected to thoracic surgical procedures require the most minute and painstaking aftercare. It is extremely important that all pulmonary secretions be expelled. If the patient is unable to clear the bronchial tree, then suction must be used. These patients are kept in the Trendelenburg position for six to twenty-four hours for the purpose of aiding endobronchial drainage, as well as for the treatment of shock. The patient must be kept warm; sufficient fluids must be given to maintain water balance; Levine suction is used to remove air swallowed during anesthesia; and blood or plasma are given for impending shock. The patient is given enough morphine to relieve pain. The majority of these patients require oxygen; the nasal catheter is the most convenient and efficient method.

The material in this discussion is based on the use of cyclopropane anesthesia in eighty-two operations on thirty-seven patients: ten extrapleural pneumothoraces and twenty-seven thoracoplasties in seventy-two stages, with no serious anesthetic accidents.

In conclusion, cyclopropane in thoracic surgery has the advantage of rapidity and ease of induction, little postoperative nausea and vomiting, minimal loss of fluids by perspiration, and few postoperative pulmonary complications. Because of the ease of induction and the absence of unpleasant postanesthetic sequelae, patients do not dread the frequent anesthesias required by an operation which is divided into several stages. No mention of end-results has been made, but one can rest assured that the real inspiration in this type of work is to see apparently hopeless invalids returned to their rightful place in society.

DEPARTMENT OF EDUCATION

THE BARBITURATES

With particular reference to their use in anesthesia

HELEN LAMB
Barnes Hospital, St. Louis, Mo.

INTRODUCTORY

The oldest of the barbiturates is *barbital*, which was introduced into medicine in 1903, under the name of "veronal." Barbital is what is termed an official drug (is listed in the U. S. Pharmacopoeia). The second oldest barbiturate is *phenobarbital*, which was introduced into therapeutics under the trade name of "luminal." Phenobarbital is also an "official U.S.P. drug."

During the following years, many other barbiturates were marketed for clinical use, their chief claim to preference being their shorter duration of action than that of barbital and phenobarbital. Among these later drugs is *pentobarbital*, which is the only member of that "less long-acting" group that is an "official U.S.P. drug." The trade preparation "nembutal" is chemically identical with U.S.P. pentobarbital sodium.

The latest advance in this field has been the introduction of a series of ultra-short-acting compounds called *thiobarbiturates*. Their chemical differentiation is that "the oxygen on the urea carbon in the barbituric acid molecule has been replaced by sulphur" (the C O of the urea is replaced by C S). The thiobarbiturate accepted by the Council on Pharmacy and Chemistry for inclusion in the N. N. R. (1940) is *pentothal* (sodium thiothal).

Classification of some of the barbiturates, according to the duration of their hypnotic action

The following designations, "long-acting," "moderate duration of action" and "short-acting," refer to the relative length of duration of effect which follows an average soporific dose, administered orally.

Long-acting Barbiturates	Average adult hypnotic dose (Goodman and Gilman)
Barbital (veronal)	4½ - 7¾ grains (0.3 to 0.5 gm.)
Phenobarbital (luminal)	1½ - 3 " (0.1 to 0.2 gm.)
Alurate	1 - 2 " (0.065 to 0.13 gm.)
Dial	1½ - 4½ " (0.1 to 0.3 gm.)
Neonal	¾ - 1½ " (0.05 to 0.1 gm.)
Nostal	1½ - 4½ " (0.1 to 0.3 gm.)
Ipral	
Those of Moderate Duration	
Amytal	1½ - 4½ grains (0.1 to 0.3 gm.)
Pentobarbital (nembutal)	1½ - 3 " (0.1 to 0.2 gm.)
Ortal	3 - 6 " (0.2 to 0.4 gm.)
Pernoston	3 " (to 0.2 gm.)
Phanodorn	1½ - 3 " (0.1 to 0.2 gm.)
Sandoptal	3 - 6 " (0.2 to 0.4 gm.)

Short-acting

Evipal	3¾ - 6	grains	(0.25	to 0.4	gm.)
Seconal	1½ - 3	"	(0.1	to 0.2	gm.)

The designation "ultra-short-acting" refers to the effect which follows an average anesthetis dose of the following named drugs, administered intravenously.

Ultra-short-acting barbiturates

Evipal
Pentothal (sodium thiothal)
Thio-ethymal (thiethamyl)

In therapeutics, the barbiturates are used more for the production of sleep than for any other purpose. They are not analgesic and therefore do not produce sedation in the presence of pain. When pain is present and hypnosis is desired, the shorter acting members are combined with salicylates (acetyl salicylic acid (aspirin) or sodium salicylate) whose *analgesic* action potentiates the *hypnotic* action of the barbiturate. When barbiturates are given in conjunction with these analgesics, only about one-third the hypnotic dose is administered. When there is no pain, analgesics (salicylates) do not potentiate the hypnotic action of the barbiturates.

In anesthetic practice, barbiturates are used for premedication, for basal supplement to anesthesia, for surgical anesthesia and less often, for obstetrical analgesia. Preanesthetic use usually consists of oral administration of one of the *longer-acting* members the night before the operation, to produce sleep, followed the next day (one hour before anesthesia) by morphine and atropine.

For general anesthesia, the preparations preferred are the *ultra-short-acting* thiobarbiturates or barbiturates (pentothal or evipal), administered intravenously. Since these agents depend upon the action of the liver for their destruction in the body, pentothal (or evipal) intravenous anesthesia should not be administered to patients with impaired hepatic function.

Pentothal vs. evipal:

According to some authorities, sodium pentothal gives a smoother and more prolonged anesthesia than evipal. With sodium pentothal, there is no tonic or clonic contraction of the muscles (twitching and spasm of the muscles of the extremities) such as not infrequently occur with evipal. Jactitation is rare with pentothal sodium, which is more powerful and rapid in action than evipal, and affords speedier recovery.

Methods of elimination from the system:

The barbiturates depend upon two different functions for elimination from systemic activity. One group, notably alurate and barbital (and somewhat less so, phenobarbital), are excreted from the body almost unchanged, by the kidneys. Another group, notably pentobarbital, pentothal and evipal, are almost completely destroyed in the liver. Some of the barbiturates (notably phenobarbital) are partly detoxified by the liver and partly excreted unchanged, by the kidneys. While one cannot predict from the mere chemical structure of a barbiturate what its route of elimination will be, in a general way it may be noted that those barbiturates with short alkyl radicals

are apt to be stable and, therefore, excreted in the urine, whereas the thiobarbiturates as a whole, and the barbiturates with complex cyclic radicals (like evipal), are less stable and almost completely destroyed in the liver.

From the foregoing it is apparent that when barbiturates are given in anesthetic doses parenterally, the duration of action and toxicity are especially dependent upon:

(a) the ability of the liver to destroy those which are *destroyed in* the body (pentothal, evipal, phenobarbital)

(b) the ability of the kidney to excrete those which are *eliminated from* (rather than destroyed in) the body (barbital, phenobarbital, alurate).

GENERAL PHARMACOLOGICAL EFFECTS

Effects upon the respiratory system:

In anesthetic doses, the barbiturates are directly depressant to the medullary respiratory center, and apparently also, in lesser degree, depressant to the carotid sinus mechanism. Both the depth and rate of breathing are decreased. The rhythm may be irregular. Death from poisoning by the barbiturates is due to respiratory failure.

Effects upon the circulatory system:

Large doses of barbiturates depress the central vasomotor center, with consequent peripheral vasodilation and hypotension. Excessive concentrations may dilate and injure capillaries to such an extent that shock ensues. A sharp fall in blood pressure may follow too rapid administration of a safe dosage of barbiturate, but the hypotension is transitory if the dose is not too large. The barbiturates do not appear to damage the myocardium, or to seriously alter cardiac rhythm.

Effects upon the nervous system:

The barbiturates are depressant to the cerebrospinal axis. Any degree of depression may be obtained, from light sedation to deep coma, according to the reflex excitability of the individual's nervous system, the barbiturate used, the dosage and the route of administration.

Untoward respiratory phenomena accompanying barbiturate intravenous anesthesia, such as laryngeal spasm (contraction of the adductor muscles with consequent closure of the glottis) sneezing or hiccoughing, are apparently due to over-activity of the parasympathetics as a result of their stimulation caused by the barbiturates (pentothal, evipal, nembutal, sodium amytal), hence the practice which is now quite generally followed, of preceding each intravenous barbiturate anesthesia by prophylactic premedication with atropine, which annuls parasympathetic effects.

Effect upon metabolic rate:

In anesthetic dosage, the barbiturates reduce the metabolic rate, and decrease oxygen consumption.

Effects upon the glandular system:

The barbiturates have no direct effect on normal renal function. Normal hepatic function, likewise, is unimpaired; but if the liver is damaged, large doses of barbiturates may further injure it.

Allergic idiosyncrasy:

Some of the idiosyncrasies to barbiturates manifest themselves in reactions which are allergic in nature. They occur in persons who tend to have asthma, urticaria, angioneurotic edema, et cetera. They manifest themselves as localized swellings of the eyelids, cheeks or lips, erythematous dermatitis, and bulbous cutaneous lesions.

Natural idiosyncrasy may manifest itself in the form of "hangover," excitement or pain. In some persons therapeutic doses of barbiturates produce excitement rather than depression, the patient appearing to be inebriated. Like other non-analgesic hypnotic drugs, barbiturates given in hypnotic dosage in the presence of pain may cause restlessness and excitement.

INTRAVENOUS BARBITURATE SURGICAL ANESTHESIA

Indications:

For selected operations of brief duration, in which profound muscular relaxation is not required, the ultra-short-acting barbiturates (sodium pentothal and evipal) are employed intravenously. The classical recommendations for their use are: reduction of fractures, dilation and curettage, cystoscopy, prostatic resection, changing painful dressings, removal of sutures, encephalography, procedures of short duration in the oral cavity, brief manipulations of simple fractures, treatment of accidental wounds, et cetera.

Some surgeons use intravenous barbiturate anesthesia in general surgery, as well as eye, ear, nose and throat (excepting tonsillectomy, the latter being less well suited because of the deep anesthesia required under this drug before the region of the pharynx is affected). In this connection, it is to be noted that when adequate airway cannot be maintained by proper position of the head, insertion of a nasopharyngeal airway (instead of a pharyngeal airway) should be resorted to, because of the pharyngeal reflex which is present except in deep anesthesia; or endotracheal intubation should be effected. Cyanosis should never be tolerated by an anesthetist.

Lundy considers intravenous sodium pentothal anesthesia particularly useful for short operations such as: manipulation of a stiff joint, reduction of a fracture or dislocation, changing a cast on sensitive patient, removal of packs and drains or application of a clamp to a colonic stoma, as well as for removal of tissue from the breast for microscopic examination.

Contraindications:

There is not complete agreement as to what constitutes contraindication to the use of intravenous barbiturate anesthesia. The classic examples of contraindication are: cirrhosis of the liver, jaundice, shock, hypotension, asthma, pulmonary disease and marked debilitation. It seems obvious that patients with impaired renal function should not be administered those barbiturates which depend upon renal excretion for elimination of the drug from the system (barbital, phenobarbital, alurate); and that patients with impaired hepatic function should not be administered those barbiturates which depend upon the liver for their detoxification within the body (pentothal, evipal, phenobarbital, pentobarbital).

Untoward responses attributable to the barbiturates are especially likely to occur in patients with fever, hyperthyroidism, diabetes mellitus, severe anemia and congestive heart failure, although these conditions do not present

obligatory contraindication to their use and excellent results are sometimes obtained from their judicious administration.

Hypotension is not in itself a contraindication to sodium pentothal anesthesia, series of cases in which it was so administered, failing to yield indications of resultant cardiac damage.

Many operators consider sodium pentothal intravenous anesthesia undesirable for children under twelve years of age, because of their susceptibility to respiratory depression and the difficulty of maintaining a patent airway, and the difficulty of venipuncture in children because of their small veins.

Lundy proposes the following contraindications to intravenous sodium pentothal:

Marked cardiac disease with decompensation (not including angina pectoris) especially in the presence of orthopnea.

Marked limitation of intercostal excursions.

If erythrocytes number less than two million per cubic centimeter.

If dyspnea may be expected to develop during or following operation.

If there is reason to believe that the respiratory passage is or may become obstructed.

A full stomach, because in view of the increased throat reflexes due to sodium pentothal, regurgitation of material into the throat may be expected, with consequent laryngeal spasm.

Patients who vomit continuously (as in the case of intestinal obstruction), because of the possibility of fatal laryngeal spasm.

NOTE: Very infrequently a patient will be encountered who reacts so unfavorably to even small amounts of sodium pentothal administered intravenously (acute attack of tremor, sneezing, coughing, vomiting, or respiratory failure) that operation may have to be postponed.

Sneezing alone is common, most often during operations on the eye. Sneezing occurs during the early part of induction, and as a rule stops when as much as 0.5 gram of pentothal sodium has been administered. The same dose has been used to control hiccup.

PRELIMINARY TO ADMINISTRATION OF INTRAVENOUS BARBITURATE SURGICAL ANESTHESIA

By reason of the idiosyncrasy which some individuals exhibit to barbiturates, it is recommended that the night before operation, one of the barbiturates (nembutal, 1½ to 3 grains) be administered to a patient who is scheduled for intravenous barbiturate anesthesia the following day. The object of this is not only to provide the patient with a peaceful night's rest, but also to furnish the anesthetist and the surgeon with valuable data as to the patient's reaction to barbiturates.

It is essential that patients who are to receive intravenous pentothal anesthesia have an empty stomach, otherwise they may vomit at the beginning of the surgical stage of anesthesia, with consequent danger of aspiration of vomitus.

The value of premedication in sodium pentothal anesthesia has been amply demonstrated. In operations associated with any great amount of pain, materially larger doses are required to produce the desired effects if preliminary medication is omitted, and in the attempt to keep the patient quiet, overdosage

is likely to result. Not less than thirty minutes before anesthesia, the patient should be given premedication with a narcotic (morphine, or preferably pantopon) *and atropine. Preoperative administration of atropine is essential,* to prevent excessive bronchial and pharyngeal secretions and to avoid laryngeal spasm consequent to barbiturate-excited hyperactivity of the parasympathetics. The dosage of morphine should be less than that used prior to inhalation anesthesia. The recommended dosage for premedication preceding intravenous barbiturate anesthesia is ⅛ to ⅙ grain, plus 1/150 grain atropine sulphate.

PREPARING AND ADMINISTERING A 2½ PER CENT SOLUTION OF PENTOTHAL SODIUM

For contemplated anesthesia of one-half hour or longer duration, aspirate into a 50 cc. syringe that is fitted with a 17 gauge "solution needle," the contents of a 40 cc. ampule of sterile distilled water (or the contents of two 20 cc. ampules). Eject this solvent into an ampule containing 1 gram (15½ grains) of pentothal sodium, plus its buffer of 60 milligrams of anhydrous sodium carbonate. Aspirate and eject the solution back and forth several times between the syringe and the ampule, to insure complete solution. Detach "solution needle" from syringe. In its place, couple to the syringe the rubber connector tubing that has previously been attached to an assembly consisting of a 3-way stop-cock (turned to "loading" position), and its attached "administrative needle" and 2 cc. syringe.

Aspirate the air from rubber tubing into the 2 cc. syringe, turn stop-cock to the "open" position, and completely eject the air from stop-cock assembly through the administrative needle into the atmosphere. Then turn stop-cock to "neutral" position until actual venipuncture is to be effected. During such interim period, the needle should be protected against contamination by covering it with alcohol-soaked sterile gauze.

When ready for venipuncture, turn stop-cock to "open" position, aspirate about ½ cc. of blood into the 2 cc. syringe to verify patency of the venipuncture, turn stop-cock to "loading" position (establishing communication between small syringe and large syringe). Load administrative 2 cc. syringe with solution from the connected 50 cc. syringe. Turn stop-cock to "open" position, and begin to inject solution slowly into the vein.

For contemplated anesthesia of short duration (less than one-half hour) and *for anti-convulsive use,* contents of an ampule containing 20 cc. of sterile distilled water are aspirated into a 20 cc. syringe fitted with 17 gauge solution needle, and then ejected into ampule containing 0.5 gram (7½ grains) of pentothal sodium plus its buffer of 30 milligrams anhydrous sodium carbonate. The resultant solution is aspirated and ejected back and forth several times to insure complete solution.

Caution:

In assembling the described outfit, it is important that the administrative needle and the 2 cc. syringe be *firmly* attached to the stop-cock. A loose assembly at those points may result in an embarrassing disconnection during administration. The rubber connecting tube must also be *firmly* attached to syringe and stop-cock, to avoid aspiration of air into the apparatus and consequent possible injection into the vein.

Be sure that syringes are so mounted that their calibrations are on top, where they may be clearly read during administration.

Note:

If a *long* operation is contemplated, and the surgeon requests intravenous barbiturate anesthesia, it is recommended that glucose-saline be administered during the narcosis. In such case, anesthesia is induced in the regular manner. Upon reaching the full surgical stage, the 2 cc. syringe is detached from the assembly, and is quickly replaced by the adapter-connection from the glucose-saline apparatus, whereupon administration of the glucose-saline proceeds through the stop-cock aperture which previously received the nozzle of the 2 cc. syringe. For the balance of the procedure, glucose-saline is administered through that connection, succeeding dosages of the anesthetic being administered *from the 50 cc. syringe* that is a part of the administrative assembly. When need for such additional anesthetic is indicated, stop-cock is turned to its third position (turned to the lever's extreme clockwise position) which interrupts communication between the glucose-saline solution and the administrative needle, and establishes instead, communication between the 50 cc. syringe and the needle. One to 2 cc. of the anesthetic solution is slowly injected from the 50 cc. syringe, whereupon the stop-cock is returned to the "open" position and administration of glucose-saline is resumed until additional administration of the anesthetic becomes indicated.

Caution:

Left-over sodium pentothal solution must not be used after it has stood for four hours.

DETAILED TECHNIQUE OF ADMINISTRATION FOR INTRAVENOUS SURGICAL ANESTHESIA

Administrative unit is assembled consisting of:—

50 cc. syringe containing the anesthetic solution
Connecting rubber tube
21 gauge 1¼" needle, for venipuncture and administration
17 gauge needle for preparation of solution
3-way stop-cock in "neutral" position
2 cc. syringe

The patient is placed on the table and the routine recording is made of blood pressure, pulse, respiration, et cetera. The three-way stop-cock is verified at "neutral" position. The arm is anchored to arm-board with ½ inch adhesive tape. The 50 cc. syringe is strapped to arm-board beside patient's arm. The 2 cc. syringe is held by the anesthetist during draping of patient (its needle protected by alcohol-soaked cotton sponge). Tourniquet is applied close to (not more than two inches above) the site of venipuncture, to anchor the vein and make it possible to put the vein on tension so that it may be entered easily. Skin overlying the vein is cleansed and venipuncture is effected. Veins generally selected for this procedure are those located:

(a) At the antecubital fossa region (accessory cephalic, cephalic, median cephalic, median antibrachial, median basilic, accessory median, basilic).

(b) On the dorsal aspect of the hand (dorsal metacarpals, dorsal venous network).
(c) On the dorsal aspect of the wrist and forearm (cephalic, basilic).
(d) At the radial region of the wrist.

The size of needle generally used for venipuncture is 21 gauge. If the vein to be entered is small (its lumen scarcely larger than the diameter of the needle), the bevel of the needle should be turned down (the bevel of the needle to be on the under side, parallel to the upper and lower walls of the vein). If entry to a small vein is undertaken with a large needle with its bevel turned up, a hematoma may form above the vein because of partial injection outside the upper venous wall that encloses only a part of the bevel opening, or a hematoma may be formed under the vein by reason of a perforation of the venous wall resulting from the effort to adjust the needle in a vein which upon removal of tourniquet partially collapses and occludes lumen of the needle. (See Figs. 2 and 3, Lundy and Osterberg.)

If the lumen of the vein to be entered is amply large with reference to the size of the needle, it is immaterial whether the bevel is turned up or down when introduced through the skin and venous wall. (See Fig. 1, Lundy and Osterberg.)

The site of venipuncture should be on the side of the patient opposite to that of the operation, where the anesthetist will be away from the operative field and in position to observe the patient's respiration.

In some extreme cases venipuncture is difficult unless moist heat is applied, to dilate and engorge with blood the veins selected. This is effected in the case of an upper extremity vein by enveloping the entire hand, wrist, forearm and arm to a point above the elbow, in a warm, moist Turkish towel, and covering it all with a wrapping of oilskin or rubber, and placing hot water bottles around it. When a vein in the ankle is to be used, the entire foot, ankle and leg to the knee should be so heat wrapped. After such treatment, with the extremity in a dependent position for twenty to thirty minutes, application of the tourniquet causes the veins to stand out prominently. The application of moist heat as above set forth, fails to accomplish its purpose if it is applied to the elbow only, and does not embrace within it the forearm, wrist and hand as well.

To effect the venipuncture, tourniquet is applied, the skin over the filled vein which is to be entered is stretched by the anesthetist's left thumb and forefinger, the needle is inserted into the vein while suction is being made by the syringe so that as soon as venipuncture is accomplished blood appears in the syringe. About 0.5 cc. of blood is aspirated into the syringe to demonstrate the efficiency of the venipuncture. The tourniquet is released and the anesthetic solution injected as needed.

Note:

Should the anesthetic solution be injected before the tourniquet is released, the releasing of the tourniquet permits a sudden rush of the accumulated dosage of the anesthetic solution to the vasomotor and respiratory centers, with consequent danger from such overdosage.

If a vein at the elbow is used, the patient's hand is clenched in order to keep the vein filled.

If uncertainty exists as to whether the needle is in a vein or in an artery, the syringe is disconnected and the character of the flow of the blood is observed (spurting if arterial). *Intra-arterial* injection of sodium pentothal brings signs of anesthesia to the anesthetist so late, that in the meantime overdosage may have been administered. Pain in the arm or a burning sensation in the hand is a warning symptom, as is also delayed induction.

If the veins at the elbow are thrombosed and it is therefore necessary to use a vein in the hand, the arm should be rubbed from the wrist toward the elbow. If possible, the site of injection in these cases should be above rather than below the thrombosed veins.

If a vein at the ankle is to be used for intravenous anesthesia, it is important to know whether or not varicosities are present. If they are, the vein must be massaged frequently from the ankle toward the knee, to speed the passage of the drug from the point of injection into the general circulation; otherwise an overdose may be administered while manifestation of approaching signs of anesthesia is being awaited.

After venipuncture has been effected and the tourniquet removed, the 3-way stopcock is turned to "loading" position; the 2 cc. syringe is filled with the anesthetic mixture; the stop-cock is turned to "administrative" position and injection is started at *a very slow* continuous rate (about ½ cc. of 2½ per cent solution during each fifteen seconds), the patient being requested to count slowly or to tell the anesthetist when he begins to feel drowsy. During injection, the patient is observed carefully for appearance of thickened or slurring speech, yawning and loss of consciousness. Upon development of these signs (which usually appear within from one-half to three minutes) injection is discontinued for the moment, the jaw is held upward and forward and the administration is interrupted for a period of thirty seconds, during which time the effect of the anesthetic is observed for appearance of "eyelid sign," muscular relaxation and automatic rhythmic respiration.

Unconsciousness occurs before muscular relaxation. (Note: In intravenous sodium pentothal anesthesia, the pharyngeal reflex is not abolished except under deep anesthesia.)

Upon development of the proper signs of anesthesia, a previously marked nasal catheter is inserted, and oxygen insufflated at the rate of 1500 to 2000 cc. per minute, increasing the flow if color signs indicate.

If the succeeding procedures are to be genito-urinary, the cystoscope may be introduced at this point. If, however, a surgical incision is to be made, the surgeon first tests sensibility of the patient by pricking the skin before making the incision. If there is any indication of sensation, the anesthetist slowly injects a few more minims of the solution, until the patient is under surgical anesthesia.

NOTE: It is to be borne in mind that the amount necessary to induce anesthesia varies greatly in individuals. Similarly, the amount necessary to maintain surgical anesthesia varies greatly with individuals. A large patient may require actually less for a long anesthesia, than some small individual for a short procedure. There is no set dosage based upon the weight of the patient—merely the general statement of a maximal dosage of 1 gram, beyond which it is recommended that other supplementary agents be resorted to if additional anesthesia is necessary.

The administration of intravenous anesthesia should be always slow, with a "resting" period after each period of fractional administration. This interruption following each administration is to enable the development of the effect of each dosage, before additional anesthetic is administered. It is to be remembered that these drugs have a cumulative action, as evidenced by the fact that the longer the operation continues, the less of the drug is required to maintain anesthesia.

It is important that extreme caution regarding the speed of injection be exercised. The patient to whom pentothal sodium is being administered has no active warning mechanism of defense, such as is initiated by the irritating action of ether. From one to two minutes (rather than the sometimes suggested twenty to thirty seconds) for the induction of anesthesia is recommended—or at least that a pause be made for thirty seconds after injection of 4 cc. of a 2½ per cent solution, to demonstrate the depth of anesthesia produced (to permit the complete effect to manifest itself). The 2½ per cent solution is recommended rather than a 5 per cent solution, to facilitate slow dosage and to avoid the rare occurrence of phlebitis, or of sloughing of tissue and irritation at the site of injection.

After the surgical stage of anesthesia has been reached, the patient responds very quickly to slight changes in the depth of anesthesia. Therefore the patient's progress must be watched closely for alterations in the depth of narcosis, and the accompanying need for lightening or deepening of the anesthesia. Indications for further injection are: slight movements of the extremities, phonation, reflex movements due to pain stimuli, or increase in depth and rate of respiration. Should the patient move or groan during the operation, surgery is not necessarily interrupted, but additional dosage is administered. Dosage during anesthesia is 1 cc. to 2 cc. of 2½ per cent solution, administered very slowly when indicated, pausing after each such injection, that the result of its cumulative effect may demonstrate itself. *(A very minute* quantity should be administered about every thirty seconds during the procedure, to keep the syringe open and free from clotting.)

A good guide to the depth of anesthesia is the degree of relaxation of the jaw, but the best single guide for depth of anesthesia is the depth of respiration. During deep anesthesia, respirations are shallow. During light narcosis, respirations are full. There are no dependable eye signs. All signs are subject to swift changes, which are associated with the rapid destruction of the drug in the body. Because of this rapid destruction, minute to minute control is possible, when the anesthetic is given in small intermittent doses.

Usually blood pressure is lowered very little during anesthesia; respiration is unchanged; the pulse rate is increased very slightly (an experimental series showed average increase of about 8 beats per minute).

If during administration accidental movement of the needle results in extravenous injection into the tissues (evidenced by localized edematous swelling), the needle is withdrawn and venipuncture re-effected. Following the anesthesia, saline solution is injected subcutaneously into the area of swelling to dilute the concentration of the barbiturate solution which has been accidentally infiltrated, or moist heat should be applied for five to ten hours.

RECOVERY

When the surgeon starts closing the fascia, the needle may be removed. In a large percentage of cases, the patient will react soon after reaching his room. This reaction is usually quiet, resembling a person awakening from natural sleep.

To lighten narcosis after the operation, inject 3 cc. metrazol intravenously, immediately following the "deanesthetization" or "hyperventilation," if indicated. Thereafter, 1 to 2 cc. may be given intramuscularly or subcutaneously at half-hour intervals for several doses, to help guard against postoperative pulmonary complications. The upper limit of dosage of metrazol has been reached, however, when transient excitation occurs.

RESUSCITATIVE:

(1) For circulatory collapse and respiratory failure during the operation, 1 to 3 cc. of metrazol are injected intravenously and oxygen plus carbon dioxide is administered endotracheally.

(2) Picrotoxin is a physiological antagonist to the barbiturates. It is administered intravenously 1 milligram (1/65 grain) per minute (1 cc. of a 1:1000 isotonic saline solution per minute) until "return of the desired reflexes."

While dramatic results have been reported from the use of picrotoxin in barbiturate intoxication, and while an individual poisoned with a barbiturate is tolerant to dosages of picrotoxin that might be fatal to a normal individual, it is to be borne in mind that picrotoxin is a highly toxic substance.

(3) Coramine, while of particular value in overcoming respiratory depression caused by morphine and by volatile anesthetic, and particularly effective in overcoming the depressant action of avertin, is said to be less effective than either metrazol or picrotoxin in rousing patients from barbiturate depression.

ANTI-CONVULSANT USE OF BARBITURATES

Intravenous administration of the barbiturates is of great value in symptomatic control of convulsions occurring in tetanus, eclampsia, status epilepticus, and cerebral hemorrhage. It is also effective in combating *convulsions occurring during general anesthesia*, as well as those caused by cocaine, strychnine, metrazol, picrotoxin, coramine and overdosage of insulin. Only barely enough should be injected to control the seizures, however, administered fractionally while the respirations and degree of muscular relaxation are carefully watched.

Usually the "ultra short acting" or the "moderate duration of action" barbiturates are selected for this purpose, and are given intravenously. The amount injected (at a slow rate, never faster than 30 to 60 milligrams (½ to 1 grain) per minute) is more important than the particular barbiturate employed. Usual doses for intravenous administration to control convulsions are:

Sodium pentothal:	1 cc. of a 2½ per cent solution each 15 seconds, until seizure is controlled (3 to 7 cc. usually suffice).

Sodium pentobarbital: (nembutal)	0.3 to 0.5 gram (4½ to 7½ grains)
Sodium phenobarbital: (luminal)	0.3 to 0.7 gram (4½ to 10½ grains)
Sodium amytal:	0.4 to 0.8 gram (6 to 12 grains)

SODIUM PENTOTHAL RECTALLY FOR BASAL ANESTHESIA

Sodium pentothal by rectal instillation has been used as a basal anesthetic. The stated dosage is 1 gram (15½ grains) for each fifty pounds of body weight, dissolved in from ½ to 1 oz. (15 to 30 cc.) of distilled water, instilled into the rectum fifteen minutes before taking patient to the operating room—patient to be attended from the time of administration, to prevent asphyxial complication from the relaxed jaw and tongue that ensue. Premeditation consists of 1/150 grain atropine sulphate (without opiate) administered hypodermically one-half hour before operation.

Sodium pentothal rectal basal narcosis is not recommended (a) when involvement of the trachea, edema of glottis or other condition exists which may embarrass respiration; (b) when there is heart impairment with decompensation; or (c) when any of the severe primary anemias exist.

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SPINAL ANESTHESIA

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FOREWORD

Most of the material in the notes presented has been compiled from the following authorities:

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ANATOMY

Vertebral Column

The vertebral column is a strong, flexible column formed by a series of bones called vertebrae. It is about 70 centimeters long in the adult male. Each vertebra consists of two parts:

1. Ventral solid portion, or body
2. Dorsal portion, or arch, formed by the pedicles and the laminae, and has seven processes (four articular, two transverse and one spinous).

There are twenty-six vertebrae in the adult, as follows:

Cervical	7	
Thoracic	12	
Lumbar	5	
Sacral	1	(5 bones in children)
Coccygeal	1	(4 in children)

Viewed from the side the vertebral column presents four curves which are alternately concave and convex. In the *horizontal position*

the cervical curve is convex
the thoracic curve is concave
the lumbar curve is convex
the pelvic curve is concave

These curves are of significance in spinal anesthesia since the thoracic curve will be lower than the lumbar when the patient is in the dorsal position. A solution of drug introduced into the spinal canal tends to gravitate into the dependent region, therefore the curves act both as localizing and limiting factors.

Spinal Cord

The spinal cord is that part of the nervous system contained within the spinal canal of the vertebral column. It extends from the foramen magnum of the skull, where it is continuous with the medulla oblongata, to about the second lumbar vertebra, where it tapers off into a fine thread called the filum terminale. Before its termination it gives off a number of fibers which form a tail-like expansion, called the cauda equina. The average length of the cord in the male is about 45 centimeters.

Structure of Cord

The spinal cord consists of gray and white matter. The gray matter in the interior is arranged in the form of the letter "H." The transverse bar is known as the gray commissure and connects the two lateral masses of gray matter. These two lateral masses consist of a ventral, lateral, and dorsal horn.

The *dorsal horn* contains cell bodies from which ascending and afferent fibers that go to the brain arise. Afferent (sensory) fibers entering the cord form synapses with these neurons.

The *ventral horn* contains cell bodies from which the efferent (motor) fibers of the spinal nerves arise. The ventral horn also contains ganglia from which arise the efferent fibers of the white rami communicantes, or preganglionic fibers which connect with the sympathetic ganglia outside the vertebral column.

Spinal Nerves

There are thirty-one pairs of spinal nerves, named for the region of the vertebral column from which they emerge. They are mixed nerves, consisting of afferent (sensory) fibers, which arise from the dorsal root ganglion situated in the openings between the arches of the vertebrae, and efferent (motor) fibers, which arise from the ventral horn.

Nerve Supply of Regions Involved in Spinal Anesthesia

12th thoracic	supplies	sensory	innervation	to	inguinal region
10th thoracic	"	"	"	"	umbilical region
7th thoracic	"	"	"	"	ensiform region
5th thoracic	"	"	"	"	nipple line
	"	motor	"	"	upper recti

2nd to 12th thoracic segments supply motor branches to intercostal muscles

Phrenic nerves arise from the 3rd, 4th and 5th cervical regions, chiefly from the 4th

Cardiac augmentor nerves arise from the 1st, 2nd, 3rd and 4th thoracic segments.

Meninges

The spinal cord does not fit closely into the spinal canal but is suspended within it. The cord is protected and nourished by the meninges, which are continuous with those of the brain. The meninges consist of three membranes:

1. The pia mater, which is vascular and is closely adherent to the cord.
2. The arachnoid, which is very delicate. It contains Pacchonian bodies, which are important in the absorption of cerebrospinal fluid into the venous sinuses.
3. The dura mater, which is the strong outer membrane. It extends to the 2nd sacral vertebra.

Cerebrospinal Fluid

The cerebrospinal fluid is found in the subarachnoid spaces.

Secretion: It is secreted (presumably) by the epithelial cells which cover the choroid plexuses of the ventricles.

Elimination: It is absorbed into the lymphatics by way of the subarachnoid spaces and along the spinal nerves. It finally enters the venous circulation.

The normal amount of fluid in the cerebrospinal system varies—usually about 150 cubic centimeters; amount in cord about 20 cubic centimeters. The fluid circulates slowly but substances diffuse rapidly through it.

Physical and chemical properties:

The spinal fluid is colorless, alkaline; consists of water, traces of protein, some glucose, some salts, and other organic substances.

Specific gravy—1.007, but may vary from 1.001 to 1.010.

Pressure varies but is always the same as that in the ventricles. In the recumbent position it is 60 to 120 millimeters of water, usually 110 millimeters.

Function of cerebrospinal fluid:

1. Forms watery cushion between brain and bone structures.
2. Protects against infection.
3. Fills up dead space.

From the anesthetist's point of view it serves as a vehicle to carry the anesthetic agent to the proper level.

PHYSIOLOGICAL MECHANISMS INVOLVED IN SPINAL ANESTHESIA

Spinal anesthesia is that form of local anesthesia with which certain areas of the body can be anesthetized by placing the anesthetic agent in direct contact with the nerve roots whose fibers supply these areas. (In other forms of local anesthesia the drug is in contact with extradural nerve fibers.)

The drug is introduced into the subarachnoid space, where it diffuses through the spinal fluid in accordance with certain physical and physiological principles. It deeply impregnates the nerve roots, cauda equina, and the nerve fibers for a short distance beyond their exit from the intervertebral

foramena; it *does not* enter the cord tissue. The drug is eliminated with the spinal fluid, having lost its activity by the time it enters the venous circulation.

Anesthesia results from a physiochemical reaction between the drug and the nerve tissues producing a block which interrupts conduction along the nerve roots. Extent of the nerve block varies in direct proportion to the concentration of the drug.

The concentration of the drug in the spinal fluid falls rapidly due to movement away from the site of injection, dilution and local destruction or fixation of the agent.[1] By fixation is meant the taking up of the drug by the nerve tissue.

The drug should reach maximum diffusion and be fixed in about fifteen to twenty minutes, so that changes in position after that time should not affect the level of anesthesia. An excessive dose, however, especially when concentrated, or weighted with dextrose, may be delayed in fixation, and movement of the patient may result in an unexpected additional nerve block.

Co Tui believes that this factor of fixation may not be as dependable as is often postulated, because studies of molecular diffusion and radial mixing of the agent in the spinal fluid indicate that a long time is required for attainment of a homogenous concentration at any given level.

Order of Nerve Block

Some nerve fibers are more resistant to the action of the drug than others. The blocks occur in the following order:

1. Sensory fibers—most sensitive to drug. Maximum block occurs in two to eight minutes. These fibers recover last.
2. Sympathetic fibers—maximum block occurs in about five minutes. These fibers recover second or first. Conduction should return in twenty to thirty minutes.
3. Motor fibers—maximum block occurs in three to twenty-three minutes, depending on concentration of drug and type of drug used. These fibers recover first.

Discussion of Nerve Blocks

In ideal anesthesia, a posterior, or sensory block would occur, while conduction continues through the anterior, or motor, nerve roots. In practice, however, all spinal anesthesias involve both sensory and motor blocks, depending upon the type of drug and technique used.

Posterior nerve block is more easily accomplished because:

1. The sensory nerve roots are more sensitive to the drug.
2. They are bathed in a more highly concentrated fluid because of the lateral position of the nerve roots, the position of the patient, and the site of injection.
3. The structure of the cord and its coverings tend to restrict anterior diffusion.

[1]Beecher.

Anterior nerve block: A certain degree always occurs; it produces good relaxation and reduces bleeding.

A high anterior block is undesirable because of the accompanying circulatory and respiratory depression.

Order of Anesthesia

1. Perineal region
2. Legs
3. Lower abdomen
4. Abdomen to costal margin.

Duration of Anesthesia—Depends upon:

1. Type of drug used
2. Amount and concentration of drug in solution

Factors Regulating the Level of Anesthesia

1. *Dosage*—The larger the quantity of the drug in a given volume of fluid, the higher will be the level of anesthesia;

   e.g., 100 milligrams of procaine in 2 cc. of spinal fluid will give a higher level of anesthesia than 50 milligrams in 2 cc. of spinal fluid. Dosage is more closely correlated to the length of the spinal canal than to the body weight. Usually dosage is determined by the level and duration of anesthesia desired.

   There is no fixed paralytic dose; the condition of the patient influences the lethal dose.

2. *Volume of Solution* — For a given quantity of the drug, as the volume containing it is increased, the anesthetic action takes place over an increasingly greater area;

   e.g., 100 milligrams of procaine crystals dissolved in 2 cc. of spinal fluid would give a higher anesthesia than 100 milligrams in 1 cc. of spinal fluid.

3. *Specific Gravity of Drug* — This is most important, not only in determining the position to be used in achieving the desired anesthesia level, but also in the production of specific type of block.

   When two solutions have a marked difference in specific gravity the heavier one will seek a lower level. In a patient placed on his back immediately after injection, a solution which is heavier than spinal fluid (hyperbaric) will reach higher along the posterior aspect of the spinal canal and will result in a higher level of sensory anesthesia than of motor anesthesia.

   With the patient in the same position (dorsal), a solution which is lighter than spinal fluid (hypobaric) will find its way to the anterior aspect of the spinal canal and will produce a higher level of motor paralysis. To allow the hypobaric solution to reach the sensory nerve fibers, the prone position is used.

4. *Gravitational Currents* — When two solutions have a difference in specific gravity, changes in the position of the container in which they are

placed will result in the heavier solution flowing toward the dependent part. It has been demonstrated that the gravitational currents are operative in the human spinal canal. The movement of a heavy solution along the canal takes place more quickly than does the radial spread by molecular diffusion.

(a) *Effect of the Curvatures of the Spine on the Gravitational Currents*

1. *Thoracic and pelvic curves* — When the body is in the recumbent position, the 3rd and 4th lumbar vertebrae are the most prominent parts of the spinal column. On either side of this prominence extends a concavity — the thoracic and pelvic curves. The thoracic curve is considerable more pronounced. A hyperbaric solution injected at L3 and L4 would gravitate partly into the thoracic and partly into the pelvic curves, where it would tend to remain in the most dependent part of these curves.

2. *Cervical curve* — In the recumbent position the cervical convexity acts as a dam, limiting the flow of the solution toward the head. If the patient is tilted head down at an angle of more than 24° this protection is removed.
When hyperbaric solutions are used, the use of pillows under the head accentuates the cervical curve.

(b) *Effect of Position on the Gravitational Currents*

Since it is known that a heavy solution will flow toward a dependent part, while a light solution will remain in the upper part, changes in position are used to achieve the desired level of anesthesia and to limit the anesthesia to that level. The term "head-down position" is used, rather than "Trendelenburg" since the table is as a rule merely tilted and a true Trendelenburg is not used.

With hyperbaric solutions:

Head down — drug flows toward head; anesthesia level higher.
Head elevated — drug remains low in canal; low level of anesthesia

With hypobaric solutions:

Head down — drug remains low in canal; anesthesia is controlled by degree of tilt.
15° to 20° for perineum and legs
10° to 15° for lower abdomen

Horizontal position, tilted 5° for upper abdomen

Elevating head — would allow drug to flow toward head
Head should never be elevated with hypobaric solutions.

Prone position — allows drug to reach sensory nerves first. The prone position also allows the drug to reach to the apex of the thoracic curve.

5. *Speed of Injection—*

The greater the speed of injection, the more complete will be the mixing. Diffusion is accelerated, because currents are set in motion and a higher level of anesthesia will result.

6. *Expansion or Barbotage—*

This is the repeated withdrawal and reinjection of the anesthetic solution. It promotes mixing of the agent and the spinal fluid and increases the volume of the solution;
e.g., 3 cc. of solution is prepared and 2 cc. is injected, then 1 cc. withdrawn. Then 2 cc. is injected, making the total volume 4 cc.

7. *Site of Injection—*

Injection in the higher interspaces will give a higher level of anesthesia. Interspaces usually used are as follows:

4th lumbar for anesthesia of perineum
3rd lumbar for anesthesia of legs and lower abdomen
2nd and 1st lumbar for anesthesia of upper abdomen.

There is danger of injuring the cord when the injection is made above the 2nd lumbar interspace.

Effect of Spinal Anesthesia on Circulation

Fall in blood pressure — This is due to vasoconstrictor paralysis.

Sympathetic fibers which emerge from the anterior thoracic and lumbar nerve roots course through the white rami communicante and join the ganglia of the sympathetic chain. The vasocontrictor stimuli arise in the medullary and spinal centers and are carried to the nerves which supply the blood vessels by way of the white rami and the sympathetic ganglia. When the nerves in the white rami are paralyzed by the anesthetic agent, these stimuli cannot reach their destination and dilatation of the blood vessels occurs. This occurs predominantly in the large visceral capillary bed and results in a fall in blood pressure due to decreased peripheral resistance.

The nerve fibers which supply the viscera leave the cord with the upper three lumbar and lower seven thoracic nerve roots. The degree of vasomotor collapse depends upon the number of these nerve roots that are involved. Serious cardiovascular changes occur only in high blocks involving the thoracic nerves.

Other factors possibly involved in producing circulatory depression:

(a) Thoraco-abdominal muscular paralysis, which diminishes the aspirating action of the thorax so that less blood is returned to the heart. Loss of skeletal muscle tone may account for some pooling of blood.

(b) Paralysis of the cardiac accelerator nerves possibly causing a slow heart beat.

(c) Cardiac dilatation and a weakening of the force of contraction of the heart, and altered hemodynamics due to impaired respiration.

If there is a fall in blood pressure, it occurs from five to twenty-five minutes after the injection and lasts about thirty minutes.

Clinical symptoms of vasomotor collapse are those of shock and resulting cerebral anemia. The fall in blood pressure is accompanied by rapid, weak pulse (or possibly slow rate if cardiac accelerators are involved); depressed

respirations; nausea and vomiting; cold, perspiring skin; cyanosis, or pallor; thirst and air hunger, with a feeling of compression about the chest; loss of consciousness.

Preventive treatment of circulatory collapse

1. Anesthesia should be limited to the level and duration necessary for specific operation by avoiding the use of large volumes and doses of the anesthetic solution and by careful observance of the factors which control the level of anesthesia.
2. Use of vasoconstrictor drugs before and during anesthesia to combat vasodilatation.

   (a) *Ephedrine* is the drug most frequently used for this purpose. It acts directly upon the ends of the vasoconstrictor fibers, giving a sustained action. Its maximum effect is exerted in about fifteen minutes.

   Injection: Ephedrine is usually given intramuscularly at least ten minutes before the intraspinal injection is made so that its maximum effect will be produced in time to counteract the action of the anesthetic. It is sometimes given with the premedication.

   Dosage: Varies with the level of anesthesia expected. 100 milligrams may be used for high anesthesia; 25 to 50 milligrams for low anesthesia. In cases of myocarditis or marked hypertension the amount of ephedrine given is one-half that usually indicated.

   Disadvantages of Ephedrine: It may cause tachycardia or cardiac irregularity. It is dangerous to use in severe shock, since a heart depressed by low blood pressure may be more sensitive to the depressant action of the drug than to the stimulating action, and heart failure may result.

   (b) *Epinephrine* — Has been used to prevent the fall in blood pressure but usually its action is too rapid and of too short duration for this purpose. It is injected deep into the gluteal muscle to allow slow absorption.

Active Treatment of Circulatory Collapse

Vasoconstrictor drugs such as:

Adrenalin 1:1000 solution, 5 to 10 minims, intravenously or intramuscularly

Neosynephrine 1% solution, ½ to 1 cc.

Ephedrine 25 to 50 milligrams

Oxygen should be given to prevent anoxia. Intravenous infusions of saline, glucose or plasma. The Trendelenburg position *should not* be used if a hyperbaric solution has been given, unless it is certain that sufficient time has elapsed for fixation of the drug. If the drug has not been fixed it will flow toward the head, causing additional nerve block.

Effect on Respiration

Mechanisms involved in the production of respiratory depression:

1. Direct action on the medullary centers by diffusion of the drug to the fourth ventricle. (The danger of central paralysis in man is not great, unless overdosage or hypersensitivity to the drug occurs.)
2. Ascending block of intercostal and phrenic nerves.
3. Insufficient flow of blood through the respiratory center as a result of circulatory depression.

The last two are probably the most common causes of respiratory depression.

There are two forms of anoxia which may be present in spinal anesthesia—

1. Stagnant anoxia, which occurs when the blood pressure falls to shock level.
2. Anoxic anoxia with accumulation of carbon dioxide in the blood—due to impairment of respiratory movements.

   While carbon dioxide is normally a central respiratory stimulant, when it reaches high local concentrations it is toxic to the normal organism. In the spinally anesthetized person it is especially toxic. It lowers the blood pressure by peripheral capillary dilatation. The vessels of the paralyzed body segments are dilated to such an extent that vasoconstriction of the still normal segments is nullified. This emphasizes the danger of using carbon dioxide as a respiratory stimulant in spinal anesthesia.

Symptoms of respiratory depression — Thoracic breathing disappears and abdominal breathing is exaggerated. The accessory muscles of respiration are used. There is possible loss of voice, cyanosis and loss of consciousness.

Treatment — For respiratory depression—oxygen inhalations under pressure

For respiratory arrest—artificial respiration with oxygen.
Treat accompanying circulatory collapse.

Drug Sensitivity

This is not likely to occur with intraspinal injection. If it does occur it is due to idiosyncrasy to the drug used or to accidental injection into the circulation.

Symptoms:

Nausea and vomiting
Excitement
Rapid pulse
Syncope
Convulsions

Treatment: Intravenous injection of a barbiturate, preferably sodium amytal grains 7½. Evipal or sodium pentothal may also be used.

Nausea and Vomiting

May be due to

(a) Circulatory collapse
(b) Intra-abdominal manipulation
(c) Premedication
(d) Drug sensitivity
(e) Psychogenic origin.

Treatment: It is necessary to determine the cause of the nausea; if accompanied by a falling blood pressure, oxygen inhalations should be started immediately.

If the blood pressure remains at normal levels, the nausea may be treated by inhalations of aromatic spirits of ammonia, applying cold towels to the patient's face, and by diverting his attention from the details of the operation. If these measures are not effective, oxygen may be given.

Premedication

There can be no set rules governing the use of premedicating drugs. The dosage and type of drug used must be individualized. The amount of premedication should be sufficient to dull the patient's apprehension, but too much medication is as undesirable as too little because of the respiratory depression it produces.

The drugs commonly used as premedicants are the shorter acting barbiturates. These are usually given one hour and a half to two hours preoperatively, with morphine and atropine given one-half hour to forty-five minutes before operation. A combination of morphine and scopolamine is also used.

Supplementary anesthesia

If the anesthesia fails or wears off before the operation is completed, any of the inhalation anesthetics, local infiltration, or sodium pentothal may be used to supplement.

Induction of a general anesthesia when the spinal anesthesia has become inadequate is sometimes difficult because the patient has been hurt and is usually nervous and excited. The induction will be rendered smoother and more rapid if the operative procedure is stopped until the surgical stage of anesthesia is established. Stimulation from the operative field will interfere with respiration and is dangerous while the patient is in the second stage of anesthesia.

Supplementary anesthesia should be started as soon as the patient becomes uncomfortable. If sufficient relaxation remains, analgesia may be used to keep the patient comfortable. If supplementary anesthesia is started early enough the patient will not retain an unpleasant memory of the anesthesia.

Care of patient under spinal anesthesia

Equipment necessary:

Gas machine for administering oxygen and supplementary anesthesia
Blood pressure apparatus
Stimulants

Aromatic spirits of ammonia
Sharp instrument for testing anesthesia level
Basin of ice — towels
Wrist straps

Proper management of the psychological aspect is of greatest importance. Each step of the procedure should be explained to the patient, so that his apprehension will be relieved, and so that he will know what to expect. He should be reassured, and an attempt should be made to divert his attention from the details of the operative procedure.

Conversation relative to the operative procedure should be avoided. If it is necessary to report changes in the patient's condition to the surgeon it should not be done in such a manner as to alarm the patient.

The preoperative blood pressure, pulse and respirations should be recorded. The anesthetist should be aware of the factors that may increase the hazards of anesthesia. She should note how the patient has reacted to the premedication.

The anesthetist should see that the patient is in the proper position for lumbar puncture. The correct position is of greatest importance in facilitating an easy, successful puncture, and is as follows:

The patient should be placed on his side with the knees drawn up closely against the abdomen. Head and shoulders should be bent forward. This flexes the back uniformly and widens the intervertebral spaces. The shoulders must be straight; imaginary lines through the acromion processes and through the iliac crests should be perpendicular to the table.

Immediately after injection of the anesthetic, the patient should be placed in the prone or dorsal position as indicated by the type of drug used. The table should then be adjusted to achieve the desired level of anesthesia. The progress of anesthesia should be determined by touching the skin with a sharp instrument, starting at the iliac crests, then testing above the nipple line to show contrast in degree of sensation. When the required level of anesthesia has been obtained, the position of the patient should be adjusted to prevent any further extension of anesthesia.

Blood pressure readings, pulse rate and volume should be checked frequently and the patient should be closely observed for symptoms of circulatory and respiratory depression.

The following information in regard to the intraspinal injection should be recorded on the anesthesia chart:

1. Drug used
2. Amount of drug and amount of spinal fluid used, if any
3. Amount of dextrose, if any
4. Dose of vasoconstrictor drug and time of injection
5. Exact time of intraspinal injection
6. Interspace used for injection
7. By whom intraspinal injection is made.

Advantages of Spinal Anesthesia

1. It affords complete muscular relaxation; the intestine is contracted.
2. Toxic effects from the anesthetic agent are reduced, therefore it is valuable when metabolic diseases, such as diabetes mellitus, kidney and liver disturbances, are present.
3. It is of value in cases where an inhalation anesthetic is contraindicated or impossible because of the presence of pulmonary disease.
4. It eliminates the danger of explosion, permitting use of electrical apparatus.
5. In cases such as operations on extremities the patient is able to take fluids and carbohydrates before and after operation, lessening the danger of dehydration and acidosis.
6. There is less danger of aspiration, since the patient is conscious and the cough reflex is present.

Disadvantages of Spinal Anesthesia

1. It is a "fixed dose" type of anesthesia. This may be counteracted by the use of the fractional, or continuous method of administration.

2. The patient under spinal anesthesia does not tolerate blood loss as well as does the patient under ether anesthesia, because of his inability to respond to hypotension with reflex vasoconstriction. This has been observed experimentally and clinically.

Contraindications

1. Diseases of the cerebrospinal system
2. Suppuration at site of puncture
3. Sepsis with positive blood cultures
4. Hypertension and hypotension. Supportive measures should be started early.
5. Visceral perforation, bowel strangulation, acute peritonitis. Some surgeons consider it harmful because of accompanying contraction of musculature of the stomach and intestines. Most operators consider it the anesthesia of choice in such cases, however, since trauma can be reduced to a minimum because of good relaxation and arrest of peristalsis; also the danger of aspiration of vomitus is reduced.
6. Cardiac decompensation, massive pleural effusions, increased intra-abdominal pressure.
7. Shock, hemorrhage, marked debility.
8. Advanced age — high nerve block dangerous, but low spinal anesthesia is of value in the aged, and is considered the anesthesia of choice in urological surgery.
9. Highly nervous and sensitive individuals.

DRUGS COMMONLY USED

DRUG	HOW SUPPLIED	TECHNIQUE OF PREPARATION AND DOSAGE
Novocaine (procaine)	*Crystals*— Sealed ampules containing from 50 mgm. to 300 mgm. *Solution*— 10% in saline. 2 cc. ampules contain 200 mgm. of drug.	Dissolved in spinal fluid 1-2 cc. for low anesthesia, 3 cc. for high anesthesia Solution given alone, or with equal volume of spinal fluid. Usual dosage: 50-75 mgm. for anesthesia of perineum and legs 100-120 mgm. for anesthesia of mid-abdomen. 150-200 mgm. for high anesthesia
Fontocaine	*Crystals*— Ampules contain 10 mgm. or 20 mgm. of drug. *Solution*— 1% in physiological saline. 2 cc. ampule contains 20 mgm. of drug.	Dissolved in spinal fluid. Usually used without addition of spinal fluid. Dosage 10-12 mgm. for low anesthesia 15-18 mgm. for high anesthesia Barbotage optional.
Spinocaine	*Solution*— 2 cc. ampules contain 200 mgm. of novocaine, also 2.2 mgm. of strychine sulphate, a solvent of alcohol 14.5% and sterile water, and an amyloprolamine combination to increase viscosity. Also supplied in 3 cc. ampules containing 300 mgm. of novocaine.	Mixed with spinal fluid by barbotage in Pitkin technique. May be used without diluting with spinal fluid, or diluted before injection. 1 cc. for low anesthesia. 2 cc. for perineum and legs. 3 cc. for high anesthesia.
Metycaine	*Solution*— 10% in distilled water. 2 cc. ampule contains 200 mgm. of drug.	Usually diluted with spinal fluid. Injected without barbotage. 3% to 5% solution usually used. Dosage should not exceed 200 mgm.
Nupercaine	2 cc. ampules containing 1:200 solution (10 mgm. of drug), also 20 cc. ampules containing 1:1500 solution. Prepared in a buffered salt solution.	4 to 10 mgm., depending upon desired level of anesthesia.

[1]Adriani, John, Pharmacology of Anesthetic Drugs.

IN SPINAL ANESTHESIA

SPECIFIC GRAVITY	TOXICITY	FIXATION	DURATION
Hyperbaric All solutions of novocaine with spinal fluid of anesthetic concentration are slightly hyperbaric. It is sometimes weighted with dextrose.	Considered safest of cocaine derivatives; one-fourth the toxicity of cocaine.	About ten minutes.	50 minutes to 1½ hours.
Isobaric — 1.0068 Weighted with equal volume of dextrose, 10% to render it consistently hyperbaric.	3 to 5 times as toxic as cocaine.	10 to 15 minutes. Anesthesia should be established in 5 to 10 minutes.	2 hours. May be of shorter duration for high anesthesia.
Hypobaric 15-20° Trendelenburg for low anesthesia. 10-15° Trendelenburg for anesthesia of legs and mid-abdomen. 5° Trendelenburg for high anesthesia. Table may be kept flat until desired level is obtained for high block, then placed in Trendelenburg. Prone position sometimes used to achieve higher sensory anesthesia.	Less toxic than novocaine.	About 10 minutes. Anesthesia should be established in 5 to 10 minutes.	2 cc. should produce anesthesia lasting 2 hours.
Hyperbaric — 1.014	Three times as toxic as novocaine.	About 10 minutes. Anesthesia established in 5 to 10 minutes.	About 2 hours; slightly longer than novocaine.
Hypobaric — 1.003 Prone position for 5 to 10 minutes. Immediate Trendelenburg position.	Five times as toxic as cocaine.	10 to 20 minutes.	3 to 6 hours.

REPORT OF THE ELEVENTH ANNUAL MEETING

REPORT OF THE PRESIDENT

This eleventh convention is unique in our ten years of existence. There is no need to remind you that our country and our profession are in the midst of a global war so big that even keen minds cannot encompass its magnitude. Never before has transportation been so difficult, and never before have we had to weigh our desire to meet together against our patriotic duty not to travel unless absolutely necessary. The very fact that we are among the favored few organizations which are allowed to convene during this second year of war, is a tribute to the importance of our activities and also may balance the inconvenience and the sacrifices that we have made in coming. This fact also carries with it the obligation that we devote our discussion to the major and most important issues which confront us.

To the long list of rationed articles—tires, gasoline, shoes, sugar, meat, and canned commodities, I shall add "words" because our time is limited and our meeting must be streamlined in order to accomplish in one day what formerly required three.

Many members of the Association are now with the armed forces. Their absence has led to depleted staffs, and because of lack of assistance the press of duty has been extremely great in departments of anesthesia throughout the country. This has made the responsibility of directing the activities of the Association more difficult than ever before for the members who hold offices and for those who are doing committee work.

Prevailing conditions limited the meetings of the Executive Committee to one during the current year. Other Executive Committee business has been carried on by correspondence.

Various members of the Board of Trustees have made several visits to Headquarters in Chicago during the past year. Mrs. Leona Peck, Secretary to the Treasurer, was appointed to visit Headquarters to make a study of space and filing facilities there. Some thought was given during the early part of 1943 to the changing of Headquarters to more spacious offices, but the move was deferred for further study.

Your President regrets to report that she was unable to accept invitations to attend the Pennsylvania and Tri-State Assembly meetings. Your Vice-President, Miss Helen Blanchard, attended the Tri-State Assembly meeting and was most favorably impressed with the gracious reception accorded her, the worthwhile activities, and the fine spirit of cooperation among this group.

Our continued growth is reflected in an unusual increase of additional members, 413 in number, during the past year. The number of applications exceeded those received last year by 100, and only a rigid adherence to our policy of requiring high standards for membership prevented a phenomenal increase. The Committee on Membership has made every possible effort to pass speedily and efficiently on all applications received. In many cases unavoidable delay has been caused by failure to receive prompt answers from

persons who have been given as reference. This problem can be remedied only by directors of schools making punctual replies to inquiries concerning candidates for membership from their respective Schools of Anesthesia.

A number of Schools of Anesthesia are being opened in an effort to meet the demand for a greater number of active anesthetists. That these new schools are eager to cooperate in meeting the educational requirements of the Association is evidenced by the many requests from hospitals for the recommended curriculum. These schools are anxious to graduate students who are eligible for membership in our organization and they have been given direction and assistance by Miss Helen Lamb, Chairman of the Committee on Education.

The Committee on Education has been concerned during the past year with giving assistance to hospitals desiring to open new Schools of Anesthesia and also the publication of instructive articles in the Department of Education in the Bulletin. In the present unsettled conditions the Curriculum Committee, a sub-committee on education, deemed it unwise to make any changes during the current year in the present recommended curriculum for Schools of Anesthesia.

The Committee on Public Relations, under the Chairmanship of Miss Blanchard, has satisfactorily handled several communications on legislation. The projects under way in this committee are plans for a library at Headquarters and the functioning of a Committee on Public Education.

The Publishing Commiteee should be commended for carrying on in the face of a critical lack of scientific material available for publication during the past year. The four issues of the Bulletin speak for themselves.

The Committee on Certification has been occupied with an all-inclusive study of the program of certification. The Chairman, Miss Miriam Shupp, will give you her report with recommendations for your consideration.

In closing this report, I wish to express my appreciation to the members of the Board of Trustees and to the various committees for the assistance which they have rendered during the past year. They have given unstintingly of their efforts in fostering the projects of our Association, and we are indebted to their activity for whatever progress and achievement our organization has shown during the past difficult year.

Throughout the world, a feeling of optimism is becoming increasingly evident. We cannot yet foresee what the future holds, but at least we hope that soon we shall face the problems of peace rather than those of war. We must not make the mistake of minimizing these problems or thinking that their solution will require less effort and less diplomacy in handling than those of the war period. However, each member must realize that her cooperation and activity are essential in making the state associations a bulwark upon which the national organization may draw when the need arises. Our national strength and growth rest upon the state and sectional associations.

ROSALIE MCDONALD

EXECUTIVE SECRETARY

Since the Association was formed eleven years ago, 4206 applications for membership have been sent to Headquarters. This includes the deferred, rejected and discontinued memberships. At present there are 3041 members in good standing, including 88 associate members.

During the past year applications seemed to "pour" into Headquarters. Even though this war period has brought on a flood of new applicants, the Membership Committees have gone over each application with infinite care, and a total of 413 were approved since the last convention.

States Leading in Membership

Pennsylvania still leads with a membership of	294
Illinois is second, with a total of	279
New York is third, the total being	230

Armed Forces

There are 272 members in the armed forces, to whom a questionnaire was sent in regard to their work in the Army and Navy. Many enthusiastic letters accompanied the questionnaires returned. These came from all fronts and were conclusive proof that the nurse anesthetist is enthusiastic over her chosen profession under any and all circumstances.

School Survey

This emergency period has made it impossible for the nurse anesthetist, and specifically an instructor in a School of Anesthesia, to leave her professional duties for even one day to survey a school.

This year eighteen survey questionnaires were sent to new Schools of Anesthesia in the process of organization. So far eight of these have been returned for study and decision by the Committee on Education.

Schools of Anesthesia

At present there are thirty-seven Schools of Anesthesia known to the Association. Each day brings with it many requests for our "list of schools." During the past year 712 lists were mailed.

Many hospital superintendents and medical directors have written Headquarters asking for a list of schools, hoping that by writing the school direct they might obtain a graduate nurse anesthetist for their hospital.

Some hospital administrators have sent one of their own capable nurses to a nearby School of Anesthesia with the understanding that she would return to them immediately after graduation.

Public Education

There have been many requests by magazines in allied fields for human interest stories about "what the nurse anesthetist is doing" and particularly, "what the nurse anesthetist in the armed forces is doing."

This year, with the Committees on Public Relations and Public Education, we are going to see more evidence of the vast scope of the work carried on by members in such widely read magazines as HOSPITALS, the official journal of the American Hospital Association. The managing editor of HOSPITALS has informed me that he will welcome articles on such timely topics as: "What New Anesthetics the Pressure of War Has Brought into Use"; "How

an Anesthesia Service Is Carried Out in a Small Hospital" and other subjects of interest to the thousands of hospital administrators who receive this journal. While our own Bulletin is anxious to receive scientific material, here is one way to let the people with whom you come into daily contact in the hospitals know about what you are doing, and how it is being done. Send your article, or any ideas concerning a good story to: Mr. John Storm, American Hospital Association, 18 E. Division Street, Chicago 10, Illinois. He will be glad to hear from you.

Radio

Along this same line of public education, our president, Mrs. Rosalie McDonald, has been asked to give a fifteen-minute broadcast during this convention period on "Wartime Anesthesia and the Bolton Act."

State Bulletins

Illinois has produced a fine state association bulletin called "ISANA." It has been enthusiastically received within the state and many fine comments have been received from other state associations. A great deal of credit is due the Illinois Publication Chairman and her committee.

This makes the third state association bulletin, the other two being those of Minnesota and Oregon. It is hoped that during the coming years many more states will join in this phase of good public relations.

Anesthesia Pamphlet

The brochure "Anesthesia: A Career for the Graduate Nurse" has been sent out to more than two thousand prospective students in anesthesia, hospital superintendents, medical and hospital libraries, newspapers and educational publications. Many calls have come in for a reprint of an article by Miss Helen Lamb, "The Education and Training of the Nurse Anesthetist."

In closing this report, I wish to thank you for your cooperation and spirit of friendship during the past year. Your personal letters have been an inspiration and they are sincerely appreciated.

MARY ELIZABETH APPEL

TREASURER

Condensed Statement of Receipts and Disbursements
for Fiscal Year Ended August 31, 1943

Cash Receipts

Application fees	$ 1114.00
Dues—American Association	9682.84
—State Associations	1035.75
Income from Bulletins	2553.60
Reserved for Trust Fund	518.60
Interest earned	66.98
Other Income	296.98
	$15,268.75

Cash Disbursements		
Publishing Bulletins	$ 2858.13	
Transfers to State Associations	399.75	
Convention expense	1241.99	
Operating expense	6621.66	
Office equipment	31.08	11152.61
Excess of Receipts over Expenditures for year		$4116.14

SUMMARY OF ASSETS:

Cash		
Commercial account, Cleveland Trust Company	$ 1058.81	
General Savings Accounts		
No. 106581, Cleveland Trust Company	4970.60	
No. 102794, National City Bank of Cleveland	2053.47	
No. D16133, Central Nat'l Bank of Cleveland	1587.59	
Trust Fund Savings Accounts		
No. 110399, Cleveland Trust Company	840.20	
No. 110398, Cleveland Trust Company	29.32	$10,539.99
Investments		
United States Savings Bonds (at cost)		9,162.00
Total Assets		$19,701.99

GERTRUDE L. FIFE, Treasurer

Certification of Audit:

I have examined the books and records of the Treasurer's Office of the American Association of Nurse Anesthetists and I hereby certify that in my opinion the statements accompanying this report correctly reflect the financial transactions for the year ended August 31, 1943, and the balances on deposit in the various bank accounts at that date.

Respectfully submitted,

(signed) CHARLES H. PIMLOTT
Accountant and Auditor

COMMITTEE ON EDUCATION

The first year of our country's participation in the war has introduced a strangely paradoxical situation into our field. On the one hand, the highly publicized demands of our armed services for nursing personnel, has so severely drained the supply of graduate nurses from which comes normally the supply of students for schools of anesthesia, that several well-established courses have been obliged to suspend functioning.

On the other hand, a parallel shortage of nurse anesthetists in the hospital field, has encouraged the inauguration of new and sometimes ineptly planned "schools" of anesthesia, no less than twelve having come to the attention of our Committee during the past year. While some of these ceased to

function upon facing the realistic problem of organizing an effective teaching staff and of assembling adequate mechanical and clinical facilities, others have continued, and will train local candidates at a didactic and clinical level that will probably present acute problems to our Membership Committee later on when these students graduate from their inadequately organized "adjusted" courses of instruction, and apply for membership in our Association. The Committee on Education is keenly alive to the imminence of such repercussions; and with the aid of the Board of Trustees and of the Membership Committee, hopes to devise a workable formula that can resolve these situations equitably when they arise.

Governmental awareness of the acute shortage that now exists in professional fields, has taken practical form in the recent enactment of the Bolton Act, one section of which implements the financing of graduate nurses through established civilian schools of anesthesia. It is expected that this project will accelerate the flow of candidates for education as nurse anesthetists, and thereby help relieve the shortage in this field that is severely affecting both civilian and Federal hospitals. It is to be hoped that this eminently desired end-result can be achieved without compromise of the education of these new entrants to our field. Every means must be exerted to that end.

The year just passed has been one of flux, in ours as well as in the field of professional education generally. The coming year bids fair to follow that same pattern. During this critical period, your Committee on Education feels that its greatest contribution may lie in defending the important gains that have been heretofore achieved in the standards of our education—encouraging in fullest manner the utilization of our already well-organized and effectively functioning Schools of Anesthesia rather than countenance the draining of the none too plentiful supply of desirable student material into ill advised or inadequately planned new teaching enterprises, whose chief justification only too often lies in merely that particular institution's desire for additional individual staff service.

The long-range future and well being of our specialized field is intertwined with the maintenance of an uncompromisingly high level of education for entrants to it. We must unremittingly defend those standards.

JANET MCMAHON
EDITH H. HOLMES
LILLIAN G. BAIRD
HELEN LAMB, Chairman

CERTIFICATION PROGRAM COMMITTEE

A special committee, designated as the "Certification Program Committee," was appointed by the Board of Trustees the latter part of 1941.

In brief, the report of this committee presented at the 1942 convention provided for certification of all present active members by waiver and certification of all properly qualified applicants by examination.

This report was approved by the membership at the St. Louis convention, 1942, and the resolution printed in the post-convention issue of the Bulletin.

Early in 1942, through the influence of a member of the American Hospital Association and one who is partial to nurse anesthetist service, a contact officer and adviser from the American Hospital Association was appointed for our group—Dr. J. R. Clemmons is that officer. The plan for certification, as approved by the membership in 1942, was submitted to Dr. Clemmons post-convention, for disposition through the proper Council of the American Hospital Association.

There are objections to the present program as follows:

1. That elevation of standards for membership in the Association will bar nurse anesthetists who do not have the qualifications for examination, but who are practicing anesthetists. That by so barring this group of practicing anesthetists, we are defeating our purpose to raise the quality of nurse anesthesia service to the extent of this group by depriving them of the educational advantages of membership.
2. That by certifying the entire present active membership by waiver, we are placing the highest and therefore the same rating on each individual of the present body of members, and that therefore the certification program will be weakened and perhaps nullified to the extent of the percentage of the least qualified of the present membership who will be privileged to become certified under the waiver.
3. That the present program set-up for examinations does not provide for a comprehensive test of the ability and fitness of the candidate in that it provides (for the present) for the theoretical examinations only.

From the membership have come many adverse comments to the program, mainly from the standpoint of paying a certification fee without apparent additional advantages to them personally from the certification.

To allow ample time for proper consideration and recommendations on the foregoing points, and to prevent further confusion in the minds of our members and candidates for membership, this Committee therefore recommends that:

1. The action of the membership assembled at the 1942 meeting on the report of this Committee be rescinded, and that the 1942 report be referred back to committee for further study.
2. All applications which have been deferred pending the inauguration of examinations, be now re-examined and these applications be either approved or rejected for membership; also that all applications from this date forward until further notice, be acted upon for approval or rejection and that the Membership Committee be so notified.

HELEN LAMB
GERTRUDE L. FIFE
ROSE G. DONOVAN
MIRIAM G. SHUPP, Chairman

CURRICULUM COMMITTEE

Because of the acute shortage of anesthetists in the civilian hospitals, and the number of institutions that are starting Schools of Anesthesia, it seemed inadvisable at this time to revise the curriculum.

The Committee feels that it would be best to wait until such time as conditions become more settled, or until after the war. The teaching programs in many of the new schools are temporary in nature, and it is impossible under present conditions to arrive at any definite conclusions in regard to their future status in relation to our educational program.

ELETTA ENGUM
MARY H. SNIVELY
ALMA WEBB
GERTRUDE L. FIFE, Chairman

PUBLISHING COMMITTEE

Financial Statement:

SURPLUS in Publishing Fund August 31, 1942		$ 210.15
Publishing Fund accumulated September 1, 1942, to August 31, 1943 (subscription price of Bulletin—50¢, deducted from dues of each individual member, plus sale of Bulletins to non-members)	$1519.50	
Income from Sale of Advertising, September 1, 1942, to August 31, 1943	1124.10	2643.60
		$ 2853.75
Total Cost of Publishing Bulletin, including postage, for year ended August 31, 1943..... (Total cost of publishing membership list in August 1943 issue—$440.09) (in 1942, $363.63)		2858.13
DEFICIT, August 31, 1943		$ 4.38

COMPARATIVE STATISTICAL REPORT FOR YEARS 1937-1943 INCLUSIVE:

Year	No. of pages exclusive of advertising	No. of copies distributed	Advertising: number of pages
1937	206	6400	28
1938	232	7075	29
1939	274	8600	30
1940	297	9500	30
1941	356	10350	32
1942	301	11150	27
1943	262	11875	26

The surplus in the Publishing Fund at the end of the last fiscal year was $210.15, representing a loss during the preceding year of $385.05. During the present year the surplus has been eliminated and there is a deficit of $4.38, although the loss during the current year was only $214.53.

As pointed out in last year's report, the cost of publishing the membership list increases from year to year, because of the steadily growing membership and the consequent increase in the number of copies printed. Beginning with 1500 copies in 1933, the total for 1943 was 11,875 copies.

Following a drop in advertising volume in 1941, 1942 and 1943, the prospects for the coming year are brighter, with one new advertiser for a full page for each of the four issues, and another taking a trial half-page. Even with this gain in income there undoubtedly will be a further increase in the deficit, not taking into account any further possible loss in advertising revenue.

Respectfully submitted,

HARRIET L. ABERG
BARBARA BROWN
MARGARET F. SULLIVAN
GERTRUDE L. FIFE, Chairman

MEMBERSHIP COMMITTEE

During the past year there have been eight meetings held by this Committee.

Applications approved	413
Applications rejected	46
Applications deferred	18
Applications from applicants not working	14
Applications referred back to Headquarters for further information	2
Applications under consideration	12
Total	505

MYRA VANARSDALE
MYRN E. MOMEYER
LUCY E. RICHARDS, Chairman

PUBLIC RELATIONS COMMITTEE

This year the Public Relations Committee was composed of three members and a subcommittee on Education composed of five members, making a total of eight committee members functioning under the same chairman.

The committee appointments were made and accepted without undue delay after the last annual meeting. In October the Chairman sent to each member an outline of the work to be accomplished during the year. This outline stated briefly the projects as outlined in the last annual report of this committee. The next step was the assignment of a definite project to each individual member, which in most part was undertaken with enthusiasm.

It is with regret that attention must be called to the fact that though it

was suggested by this committee, sanctioned by the Board of Trustees and approved by the membership that "all Assemblies conform to the groupings of the American Hospital Association, function without By-Laws and file notification of their existence with the Chairman of the Board of Trustees," such groups have not cooperated in following these suggestions.

To complete the second project as outlined last year, namely, the functioning of Legislative Committees, a notice was published in the Bulletin reminding the state associations of their responsibility. Then a letter was sent to each state President and finally a questionnaire was sent out. Tabulation showed the results to be incomplete and unsatisfactory.

The problem of a library at Headquarters has been given a great deal of time and study. A resumé of what has been accomplished is outlined herein:

1. A plan devised for financing, presenting to and collecting from the states has been recommended to the Board of Trustees.
2. A list of books recommended for reference and general library use.
3. A plan of purchasing, indexing and loaning.
4. Names recommended and approved by the Board of Trustees to serve on a Library Committee.

It is a pleasure to report an unsolicited contribution of $25.00 from the Illinois Association of Nurse Anesthetists toward the Library Fund. This money has been deposited with the Treasurer, and the Committee wishes to express for the membership our appreciation and thanks to the Illinois Association for this generous gift.

Our fourth objective, which was Public Education, was undertaken with enthusiasm by members of this committee at the beginning of the year, but the results of this endeavor have not been very gratifying.

A great deal of credit is due the members of this committee for their efforts and cooperation and I take this opportunity to express my appreciation for their loyal support.

This Committee suggests that the membership give to the Board of Trustees their ideas for developing this particular and most important phase of our work.

Respectfully submitted,

ROSE G. DONOVAN
ALICE M. RACETTE
VIRGINIA M. FOLEY
MARGARET F. SULLIVAN
MRS. JACK K. CHILDRESS
MRS. HELEN YOUNG WALKER
DEAN EBERHARDT
DAGMAR A. NELSON
HAZEL BLANCHARD, Chairman

Because a quorum of the general membership was not present at the meeting held in Buffalo September 13, 1943, the present officers, as listed below, will serve for another year or until the next meeting.

President	Rosalie C. McDonald Emory University Hospital Emory University, Georgia
Vice-President	Hazel Blanchard 2342 — 15th Street, Troy, New York
Treasurer	Gertrude L. Fife University Hospitals, Cleveland, Ohio
Historian	Louise E. Schwarting Lutheran Hospital, Fort Dodge, Iowa

MISS APPEL RESIGNS

Miss Mary Elizabeth Appel, who has served the American Association of Nurse Anesthetists as Executive Secretary since October, 1941, resigned effective October 1, 1943, having accepted a position in New York.

The Board of Trustees wishes to express its appreciation of the interest and enthusiasm shown by Miss Appel in the Association work, and wishes her success in her future activities.

In Memoriam

Sister M. Cornelia Lee, of St. Francis Hospital, Breckenridge, Minnesota, died July 23, 1943. Sister Cornelia had been a member of the Minnesota and American Associations of Nurse Anesthetists since 1937.

ACTIVITIES OF STATE ASSOCIATIONS

MICHIGAN

Michigan anesthetists will meet November 13 at 8:00 P.M. in Ivory Room, Statler Hotel, Detroit. Program is as follows:

"Shock in Its Relation to Blood and Plasma Loss" (with slides)
Harry K. Ransom, M.D., Associate Professor of Surgery, University of Michigan, Ann Arbor

"Continuous Intravenous Drip Method Pentothal Sodium" (with slides)
Sister Borromea, O.S.F., Director, School of Anesthesia, St. Francis Hospital, Peoria, Ill.

"Freezing as the Anesthetic Agent in Amputations of Lower Extremities" (with slides)
Conrad R. Lam, M.D., F.A.C.S., Associate Surgeon, Henry Ford Hospital, Detroit

WASHINGTON

Officers elected:

President	Sylvia M. Chapman Tacoma General Hospital, Tacoma
Vice-President	Mrs. Agnes E. Presnell Newport Community Hospital, Newport
Secretary	Mrs. Marguerite Layton 3508 — 39th Ave., S. Seattle 8
Treasurer	Mrs. Marcella A. Wilhelmy 2002 N. Division St., Spokane
Trustees:	June C. Roberts Elizabeth A. Scully Marianne McEachern

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CORRECTIONS IN MEMBERSHIP LIST

Lt. Marion L. Anderson was incorrectly listed as Marion L. Morse.

The following names were omitted through error from the paid membership list published in the August 1943 issue:

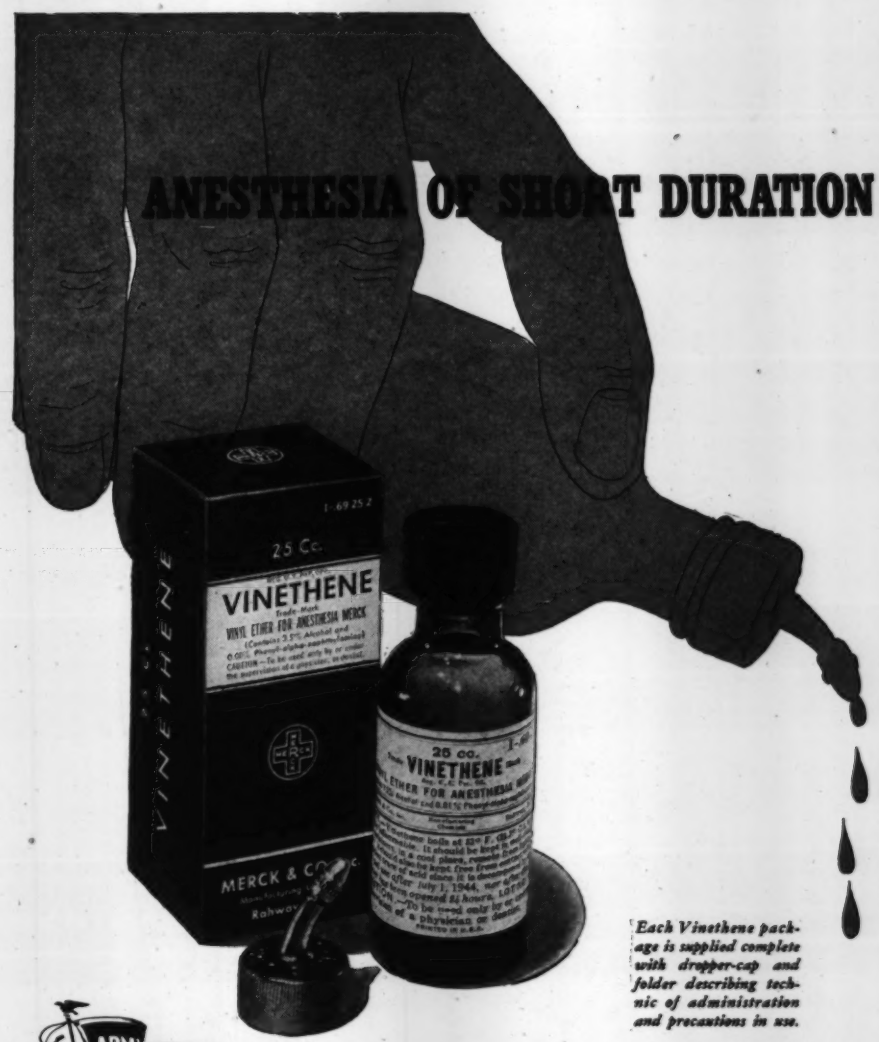
Hester, Allene	1155 Springhill Ave.	Mobile, Ala.
Hammond, Mrs. Alyce P.	P. O. Box 166	Centreville, Md.
Dickison, Hazel M.	1146 N. Kedzie Ave.	Chicago, Ill.
Hatchett, Mrs. L. E.	304—4th Ave., South	Columbus, Miss.
Thompson, Ellie	Columbus Hospital	Columbus, Miss.
Christensen, Mrs. Agnes C.	Good Samaritan Hospital	Williston, N. Dak.
Haugan, Mrs. Eldred R. (active instead of associate)	1308 W. 18th St.	Sioux Falls, S. Dak.
Angland, Margaret M.	Kings Daughters Hosp.	Gulfport, Miss.

OKLAHOMA

Oklahoma Anesthetists met at Wesley Hospital, Oklahoma City, Sept. 29, 1943, and elected the following officers:

President:	Mary E. Gough Wesley Hospital, Oklahoma City
Vice-President:	Mrs. Charles F. Bennett 803 N.W. 19th St., Oklahoma City
Secretary-Treasurer:	Mrs. H. W. Bertram Wesley Hospital, Oklahoma City

ANESTHESIA OF SHORT DURATION



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Peritonitis and adynamic ileus

Central Nervous System Conditions:

Cerebral thrombosis or embolism
Severe concussion or skull fracture
Migraine headaches

Heart Conditions:

Angina pectoris
Congestive heart failure
Coronary thrombosis

Lung and Respiratory Tract Conditions:

Asphyxia . . . Asthma . . . Dyspnea
Laryngeotracheo bronchitis
Pneumonia—lobar and bronchial
Pulmonary edema, embolism, emphysema, or fibrosis

Obstetrical Conditions:

Antepartum:
- Eclampsia
- Fetal heart arrhythmias (decreased rate)

Postpartum:
- Shock following section
- Severe hemorrhage
- Asphyxia neonatorum
- Respiratory distress in premature infants

Postoperative Conditions:

Following surgery of the:
- Brain, chest, heart, thyroid, or upper abdomen.

Systemic Conditions:

Gas and drug poisoning
Fever therapy, supportive during
Hemorrhage (severe)
Sepsis—profound or acute
Shock or circulatory failure, due to:
- Burns, surgery, or trauma

References and reprints on many of these subjects and complete information on the mechanical phases of oxygen administration are available through Linde.

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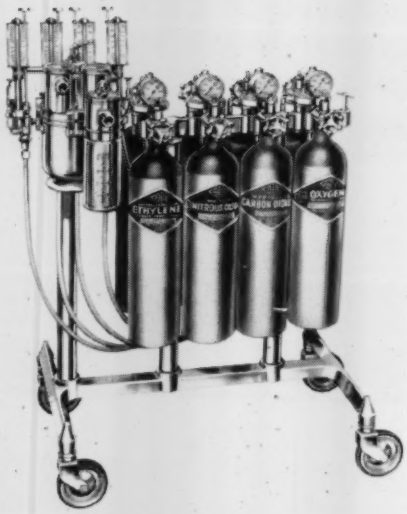

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